Emergency Environmental Health Forum Keynote

Berlin, April 12-13, 2018

Melissa Opryszko
Oliver Cumming

LONDON SCHOOL of HYGIENE &TROPICAL MEDICINE

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Berlin

"A conference for the discussion of the cholera question"

Berlin 1884

First complete presentation of his findings from Egypt and India, later published in 1887

SOURCE: Koch.(1887)

Emergency Environmental Health Forum

LONDON SCHOOL of HYGIENE &TROPICAL MEDICINE

EEHF 2016

- 119 registered attendees
- 31 abstracts submitted and 22 accepted
- Approx. 30 agencies represented

EEHF 2018

- 180 registered attendees and we were oversubscribed and had to turn people away
- 65 abstracts submitted and 24 accepted
- Over 40 agencies and institutions represented

Emergency Environmental Health Forum

Ignition

Oxygen

Fuel

Emergency Environmental Health Forum

Review committee comprising research, operational, and donor organisations

1. **Sanitation Challenges**
2. **Faecal Sludge Management**
3. Outbreaks and Undernutrition
4. **Sanitation design**
5. Sustainability
6. Cholera
7. Handwashing and hygiene promotion
8. **Waste water treatment and sewers**

Assessment Criteria:

- Relevance to sanitation
- Relevance to emergency WASH
- Novelty
- Potential to influence emergency WASH programming

Sanitation – a forgotten foundation?

Sanitation – A forgotten foundation

Sanitation in global health and development

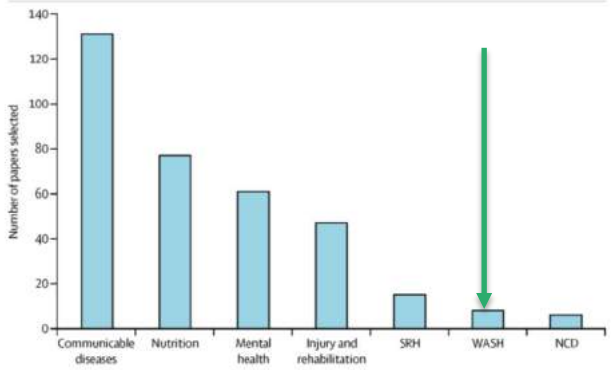
- International Year of Sanitation 2008
- Range of policy and financing commitments
- Investment in sanitation and health research
  - Diarrhoea - Clasen et al 2010
  - Undernutrition - Dangour et al 2013
  - Not a single RCT.

2008, near Berlin Central Station

Evidence base for sanitation and health

General paucity of evidence for public health interventions in emergency settings; with WASH one of the most neglected areas

(Blanchet et al 2017)

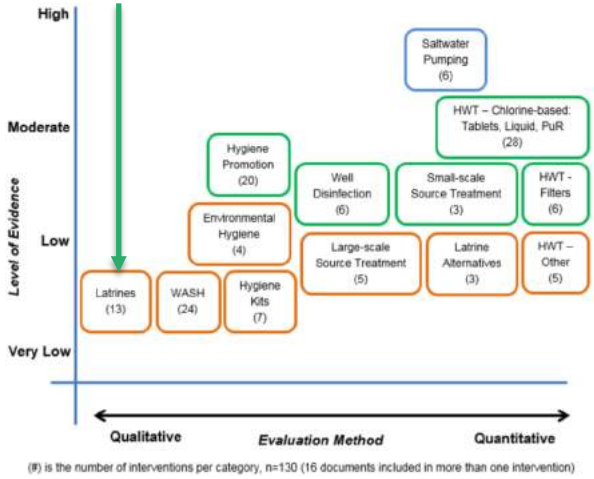


SOURCE: Blanchet et al 2017

Very few studies of impact of WASH interventions on cholera

(Taylor et al 2015)

- Mostly low quality, observational studies
- Mostly evaluating water treatment at source and point-of-use
- Most intervention studies in endemic settings
- Very few water and sanitation infrastructure



SOURCE: Yates et al 2017

Sanitation and health

No rigorous trials identified that evaluated effect of sanitation on undernutrition (Dangour et al 2013)

No rigorous trials identified that evaluated effect of sanitation on diarrhea (Clasen et al 2010)

No Effect (HAZ)	**Effect (HAZ)**
Orissa Trial (India) – no effect (Clasen et al 2015) Maharashtra Trial (India) – no effect (Patil et al 2015) TSSM Trial (Indonesia) – no effect (Cameron et al 2015) WASH-Benefits Bangladesh – no effect (Luby et al 2018) WASH-Benefits Kenya – no effect (Null et al forthcoming) SHINE Trial (Zimbabwe) – no effect (Humphrey et al forthcoming)	Madhya Pradesh (India) – positive effect (Spears et al 2016) CLTS Trial (Mali) – positive effect (Pickering et al 2015)

o studies in humanitarian settings

Sanitation and health

Measuring the right things so that trial results can be appropriately interpreted and applied

Fidelity	Compliance	Exposure	Disease	Consequence
Latrine Coverage	Open defecation	Soil, water, flies…	Diarrhoea, helminths	Stunting
Availability of treatment	Consistent treatment	Water	Diarrhoea	Stunting

"Most of the studies reviewed failed to adhere to the WHO Minimum Evaluation Protocol for the evaluation of WASH studies"
(Taylor et al, 2015)

Sanitation and health - cholera

Good evidence for efficacy and effectiveness of killed whole cell oral cholera vaccines

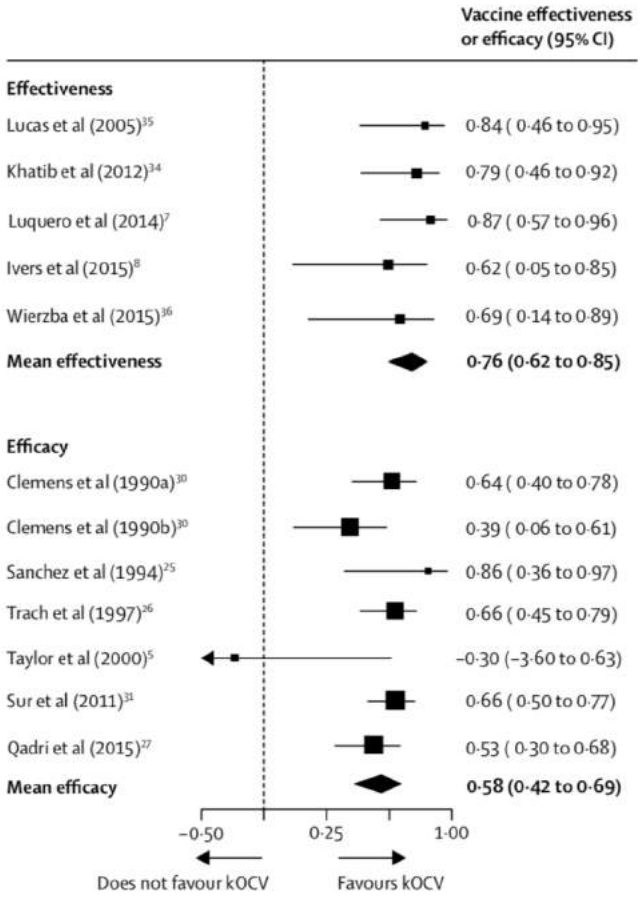
(Bi et al 2017)

Evidence from Bangladesh in an endemic setting that that a single dose OCV may be effective.

(Qadri et al 2018)

Very few rigorous evaluations of WASH interventions and cholera

(Taylor et al 2015)



Bi et al 2017

Sanitation and health cholera

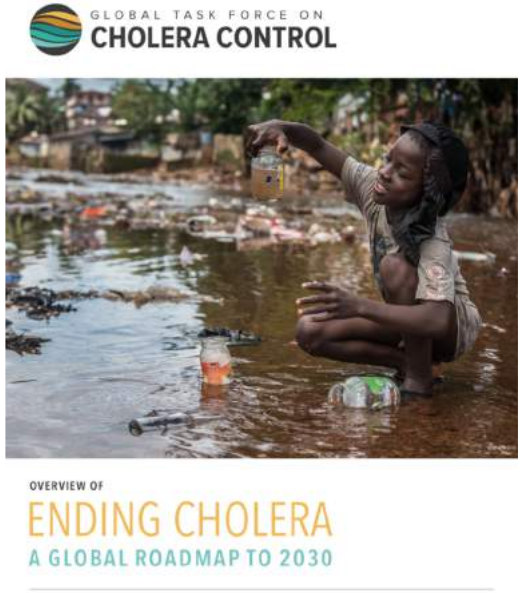
Challenges with OCV:

- Availability and timely deployment of vaccine
- Vaccination/protection lag (approx. 1 week)
- Efficacy among children much lower
- CTC admissions negative for cholera

Integrating OCV with responsive WASH interventions may mitigate some of these challenges

(George & Sack 2017)

Major questions for the WASH community as to if/how/when we deploy WASH interventions alongside OCV



Growing consensus on research & practice

Case Study:

Kathmandu EEHF 2016 proposed an agenda setting meeting

Supported by ELHRA and took place in July 2016

Important consensus:

- Role of research and evidence in strengthening responses
- Set of key research priorities
- Identified barriers to implementing research

SOURCE: D'Mello-Guyett et al 2018

Thank you!

mopryszko@ofda.gov

oliver.cumming@lshtm.ac.uk

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Evidence Into action: Introducing a cross-sectoral Toolkit for integrating Menstrual Hygiene Management (MHM) into humanitarian response

David Clatworthy, International Rescue Committee
Marni Sommer, Columbia University Mailman School of Public Health
Maggie Schmitt, Columbia University Mailman School of Public Health

COLUMBIA UNIVERSITY | MAILMAN SCHOOL of PUBLIC HEALTH

INTERNATIONAL RESCUE COMMITTEE

r2hc Research for health in humanitarian crises | elrha

Background

- In emergencies, women and girls often lack access to basic menstrual materials and toilets are inadequate. Privacy is often non-existent.
- Poor coordination across sectors; Guidance often concentrated within WASH sector, failing to incorporate the range of sectors needed.
- In response, Columbia University and the International Rescue Committee (IRC) developed a new research partnership in 2015.
- Strong partnerships also developed with over 45 humanitarian organizations and actors.

The development of this toolkit is supported by the Research for Health in Humanitarian Crises (R2HC) program, an initiative of the Enhanced Learning & Research for Humanitarian Assistance (ELRHA).

Piloting the toolkit

- A six month pilot in 3 camps in NW Tanzania; Burundian and Congolese refugees
- Two dedicated staff (WASH and Protection) led out pilot activities
- A introductory MHM toolkit workshop was held in October 2016 with 34 cross-sectoral actors from 13 different organizations working across the 3 camps.

Key pilot activities included:

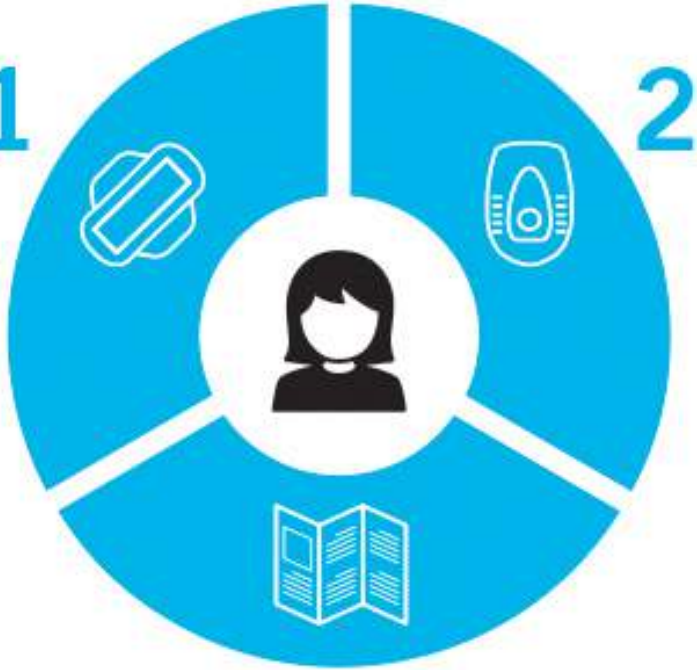
- Staff training and coaching, as well as engagement with clusters, sectoral partners and inter-agency working groups.
- Border point pilot project developed in collaboration with Health Sector to identify and provide MHM supplies to menstruating girls and women arriving at border points.
- Supported education, protection and border staff with toilet improvements.
- Supported education actors with provision of adolescent girl's and boy's education in the form of translated puberty books at schools.

Key learning from pilot evaluation

An MHM response in emergencies = 3 essential components

1 MHM MATERIALS & SUPPLIES

- Appropriate menstrual materials (pads, cloths, underwear).
- Additional supportive materials for storage, washing and drying.
- Demonstration on how to use MHM materials.



2 MHM SUPPORTIVE FACILITIES

- Safe and private toilet and bathing facilities for changing, washing and drying menstrual materials.
- Convenient and private disposal options for menstrual waste.
- Waste management systems in place for menstrual waste.

3 MHM INFORMATION

- Basic menstrual hygiene promotion and education.
- Basic menstrual health education (especially for pubescent girls).
- Address harmful cultural norms related to menstruation.

The ‘4Cs’ of MHM Response

Coordination

Across sectors and organizations

Culture

Consideration of social norms around MHM

Communication

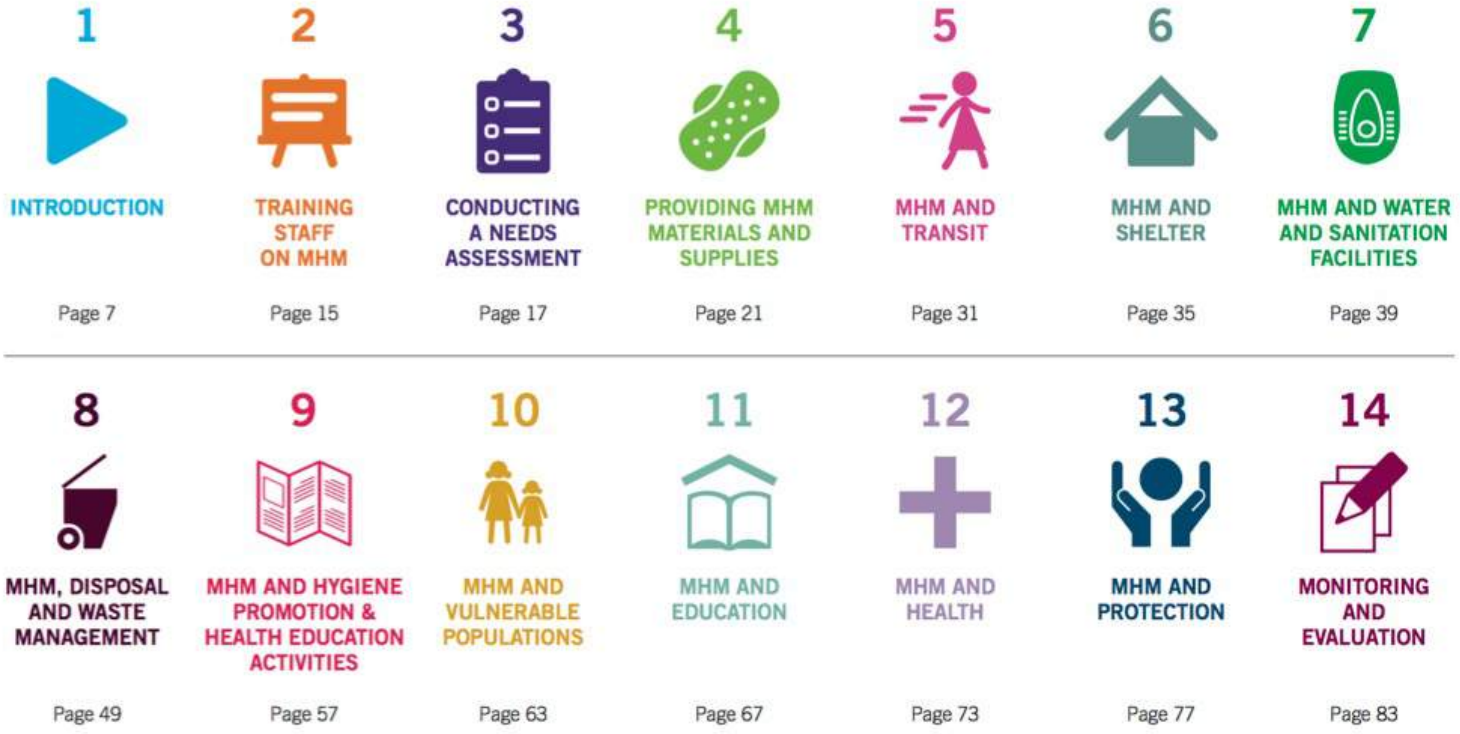
Amongst relevant stakeholders

Consultation

With adolescent girls and women

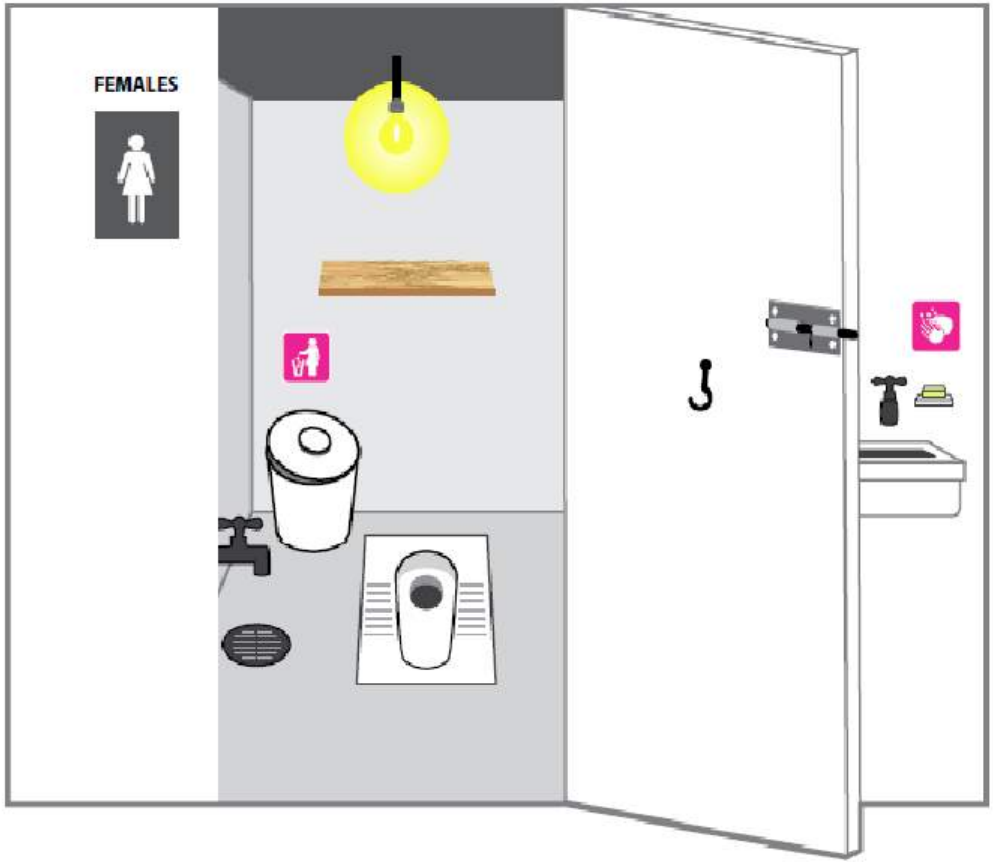
These are emphasized throughout the toolkit, specific to the various topics discussed.

Multi-sectoral response is challenging, but essential



Toilets- not yet meeting the needs of women and girls

FIGURE 2: EXAMPLE OF A FEMALE FRIENDLY TOILET



- Adequate numbers of safely located toilets separated (with clear signage) from male facilities.
- Safe and private toilets with inside door latch
- Clear signs instructing girls and women to dispose of menstrual waste in the trash bin
- A shelf and hook for hygienically storing belongings during usage.
- Night time light source both inside and outside of the toilets
- Easily accessible water (ideally inside the cubicle) for girls and women to wash themselves and menstrual materials.
- Trash bins (with lids) to dispose of used menstrual materials
- Walls, door and roof are made of non-transparent materials with no gaps or spaces.
- Some units should be accessible to people with disabilities.

Find the toolkit at:

https://www.rescue.org/resource/menstrual-hygiene-management-mhm-emergencies-toolkit

https://www.mailman.columbia.edu/become-student/departments/sociomedical-sciences/programs/menstrual-hygiene-management-emergencies

tinyurl.com/MHMtoolkit

MHM in emergencies toolkit

Remaining gaps in practical evidence:

- Culturally appropriate disposal mechanisms and waste management systems
- Laundry and drying of reusable materials
- Operating and maintaining female friendly toilets
- Strategies for better involving boys and males in MHM response.
- Strategies for ensuring coordination on MHM is sustained across sectoral actors and agencies.

Shining a light on sanitation

Looking at the impact of latrine lighting on sanitation use and gender-based violence in humanitarian contexts

Brian Reed et al

Funded by HIF

Oxfam

WEDC

Loughborough University

What the literature says

- Lots of policy recommendations
  - but very little evidence
  - mostly anecdotal and context specific
- Poor/ no correlation between crime and lighting
- The most relevant technical guidance is 30 years old
  - and relates to traffic lighting not pedestrians
- Mostly gaps in knowledge

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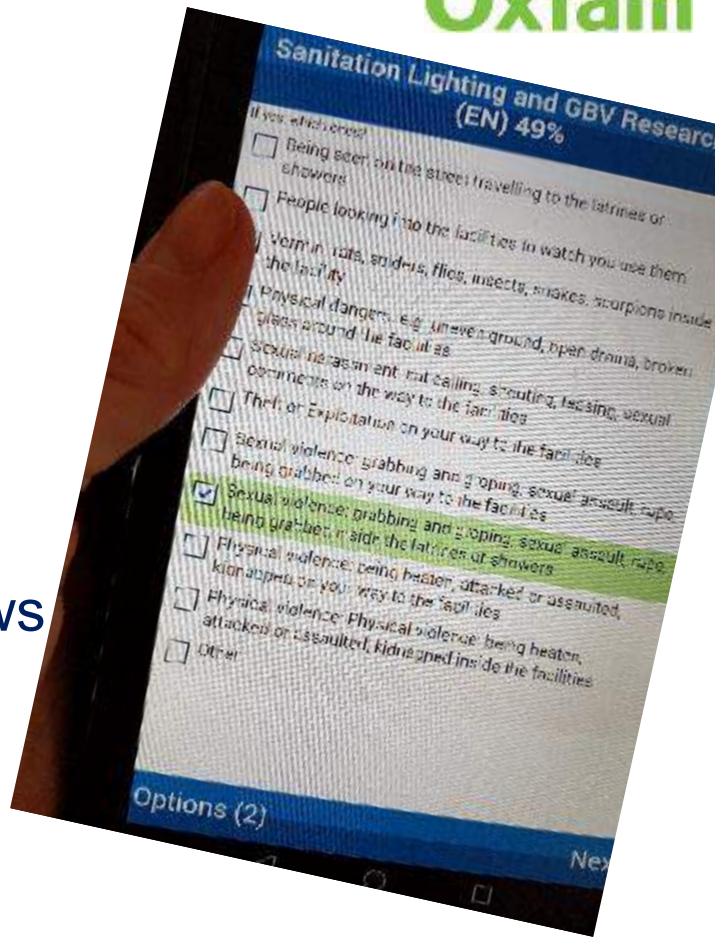
Investigation

- International key informant interviews
- Three case studies
  - Iraq, Nigeria, Uganda
- Baseline surveys
  - Questionnaires, observations, focus groups, local key informant interviews
  - Protection, WASH, logistics
- Intervention (lighting)
- Endline
- Analysis and dissemination



Case study: Uganda

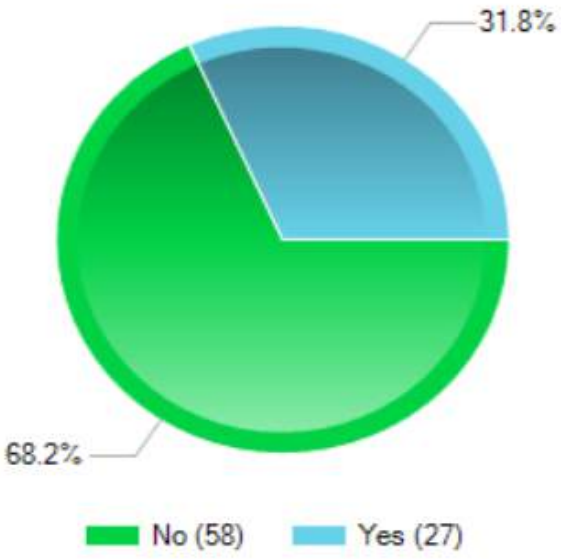
- Huge, low density settlements (not camps!)
- Temporary communal latrines (10 HH)
- Facilitated to build HH latrines
- Some distribution of solar lamps

Baseline highlights

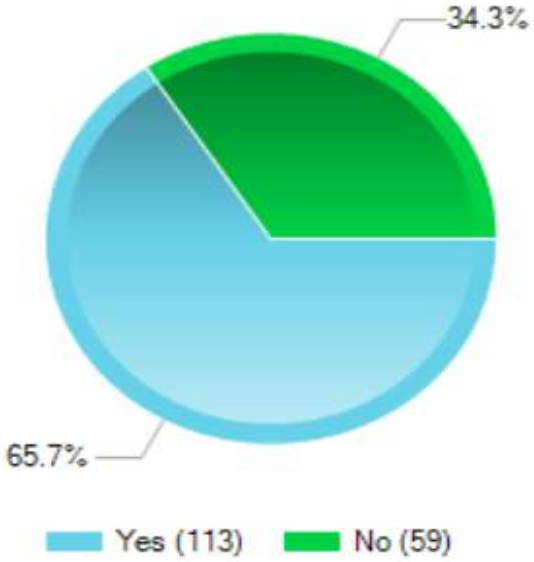
- Water points are dangerous
  - tankering at night
- Fear of vermin
  - snakes and scorpions
- Very low use of latrines
  - especially at night
  - OD or use buckets/ bowls
- Separate latrines – or separated?
  - (especially in Iraq)

Do any of these risks prevent you from using the facilities during the **DAY**?

Baseline



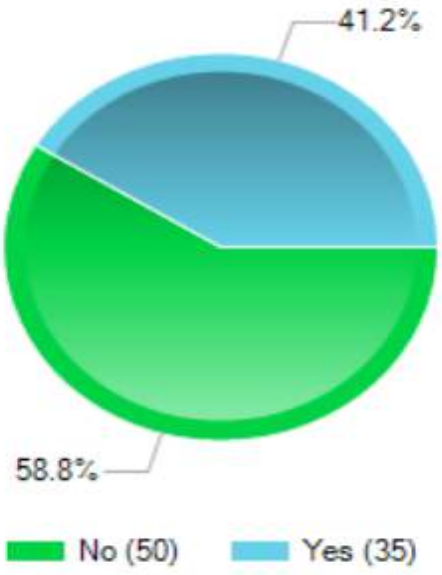
MALE (n=85)



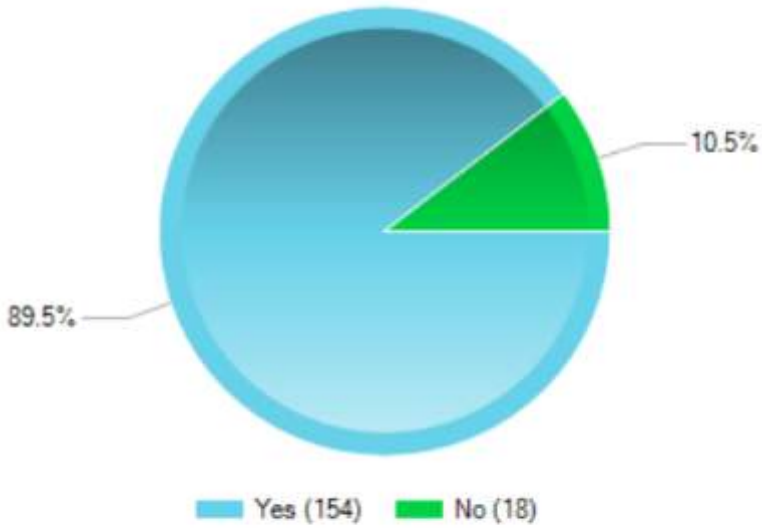
FEMALE (n=173)

Do any of these risks prevent you from using the facilities during the **NIGHT**?

Baseline



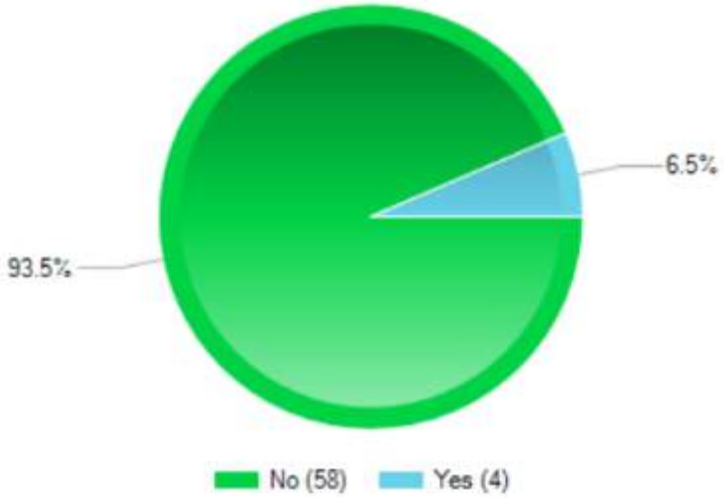
MALE (n=85)



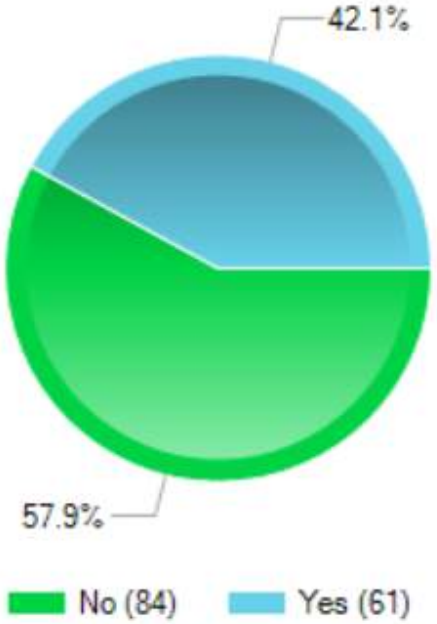
FEMALE (n=173)

Do any of these risks prevent you from using the facilities during the **DAY**?

End line



MALE (n=62)



FEMALE (n=145)

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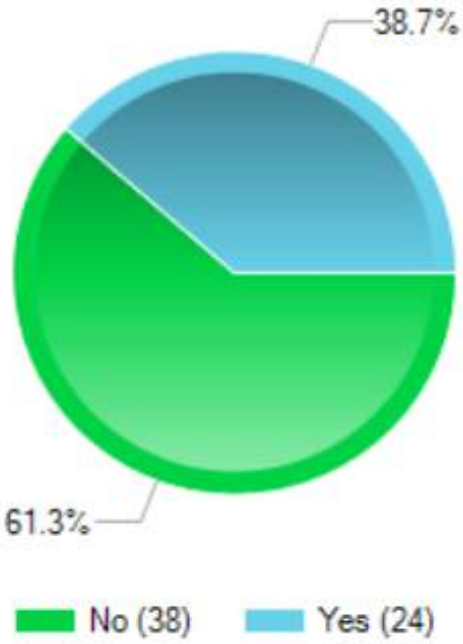
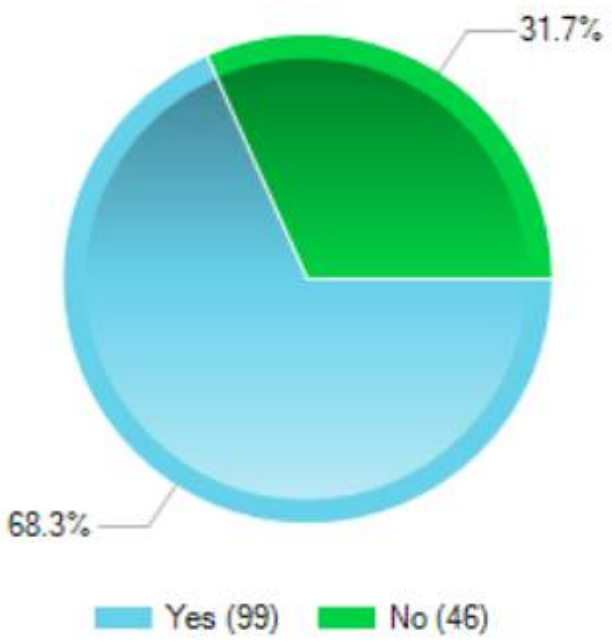
Do any of these risks prevent you from using the facilities during the **NIGHT**?

End line



MALE (n= 62)



FEMALE (n=145)

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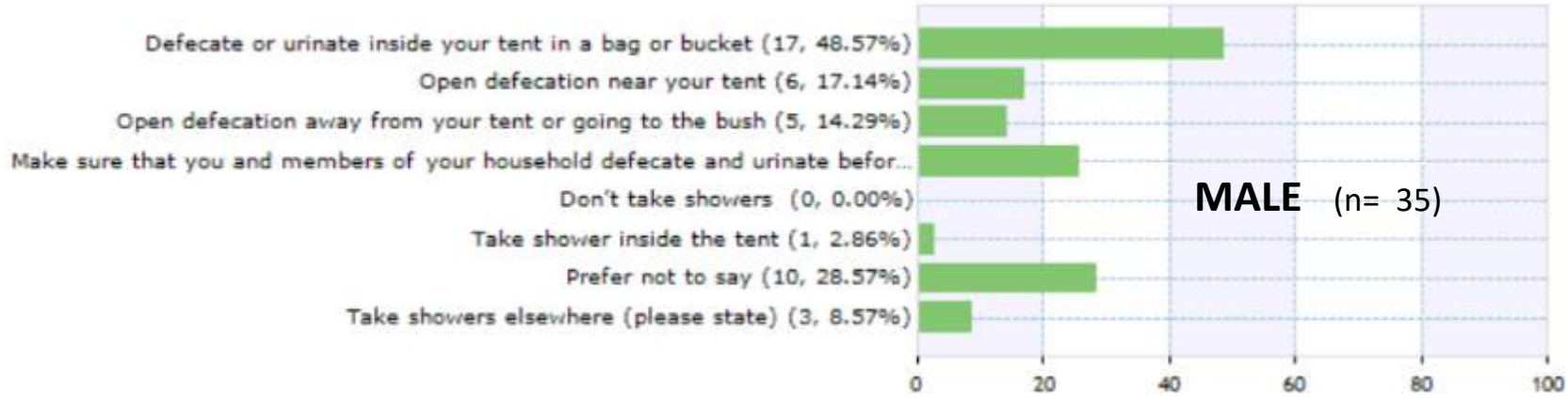
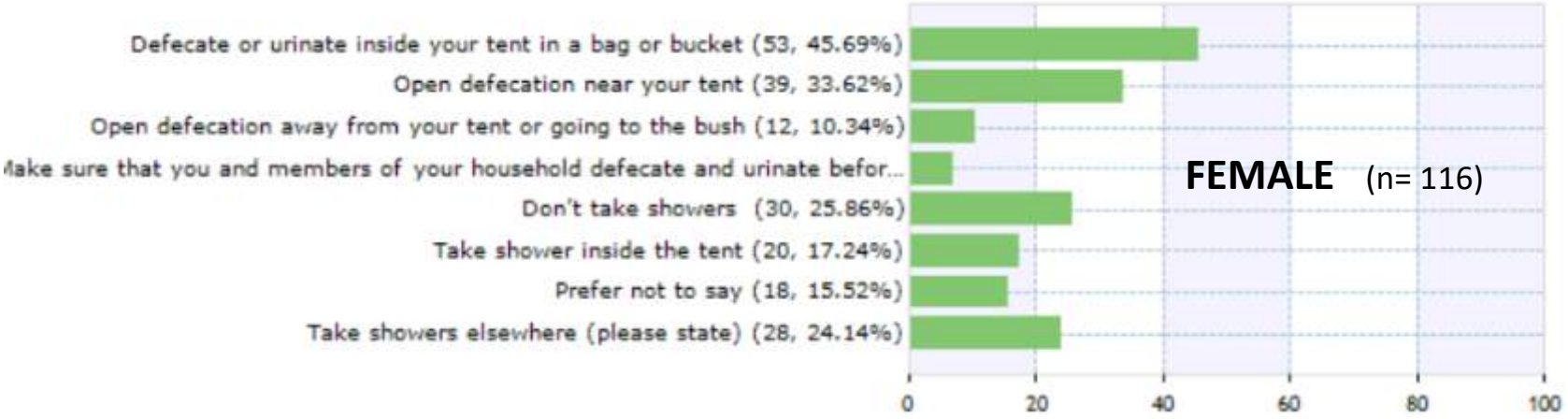
If any of the risks prevent you from using the facilities, what do you do instead?

End line





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Initial endline headlines

- Reduction in crime and GBV
  - but correlation is not causation
- Positive feeling about lighting
  - impact on policing, ambulances, health, medical waste and handwashing
  - the “bush” has become “home”
- Impact on sanitation less clear
- Technical and management problems
  - coordination, foundations, panels, theft, location, torches or lamp posts

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Any bright ideas?

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Eawag:
Swiss Federal Institute of Aquatic Science and Technology

eawag
aquatic research

8th Emergency Environmental and Health Forum Berlin 2018:

Mental health in emergency contexts: Does poor mental health impair WASH-related behaviors in a vulnerable population of rural Malawi?

Jurgita Slekiene & Hans-Joachim Mosler

Belgian Red Cross Flanders

Environmental Social Sciences
Environmental & Health Psychology
jurgita.slekiene@eawag.ch

Background

Why mental health is important in WASH context?

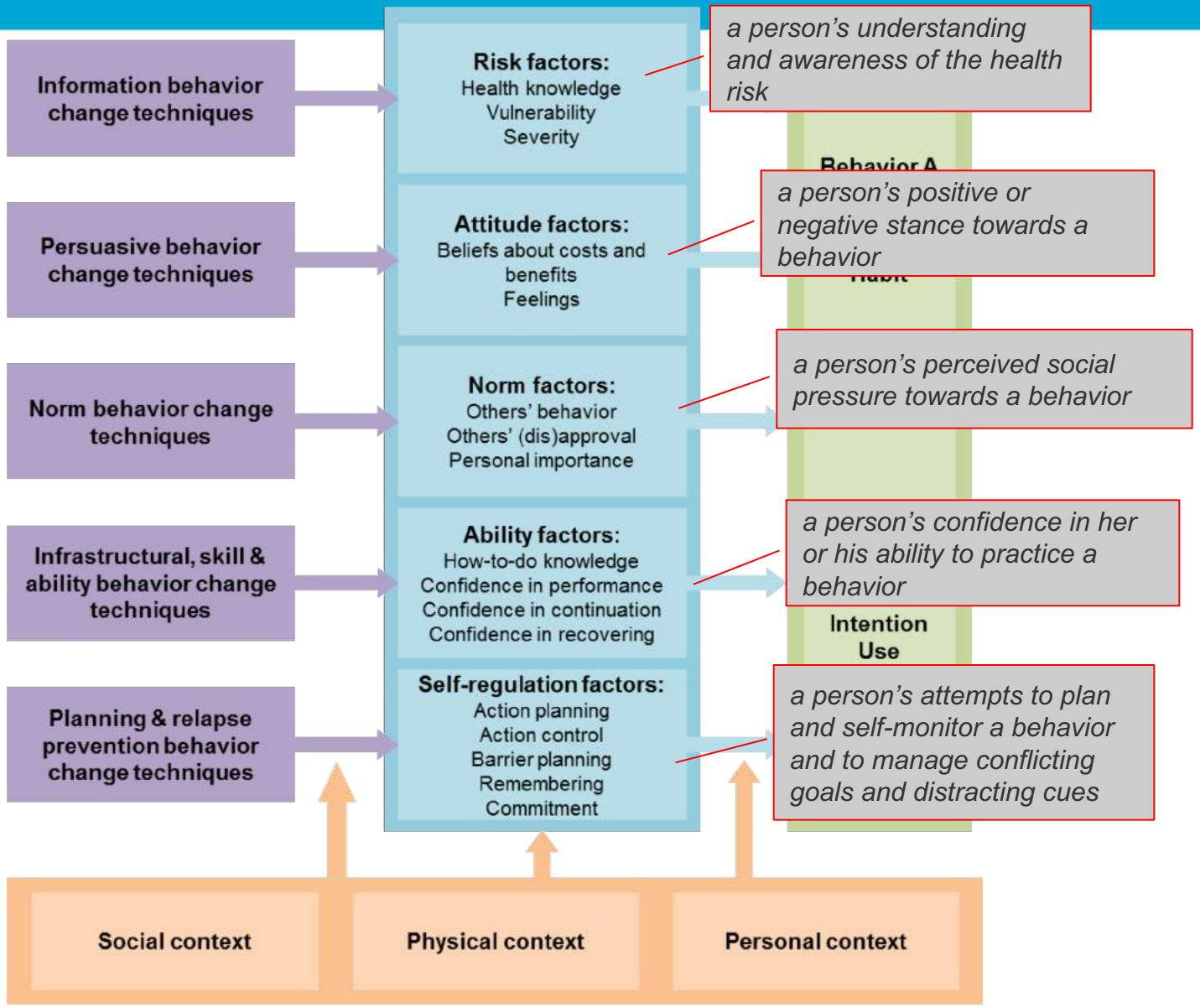
- Mental disorders are common long-term psychological outcomes in emergency contexts arising from conflicts, natural disasters or other challenging environmental conditions.

- In emergencies, people suffer not only from the lack of external resources, such as scarcity of drinking water or food, but also from poor mental health.

- Mental disorders can impair daily activities in vulnerable individuals (WHO, 2018).

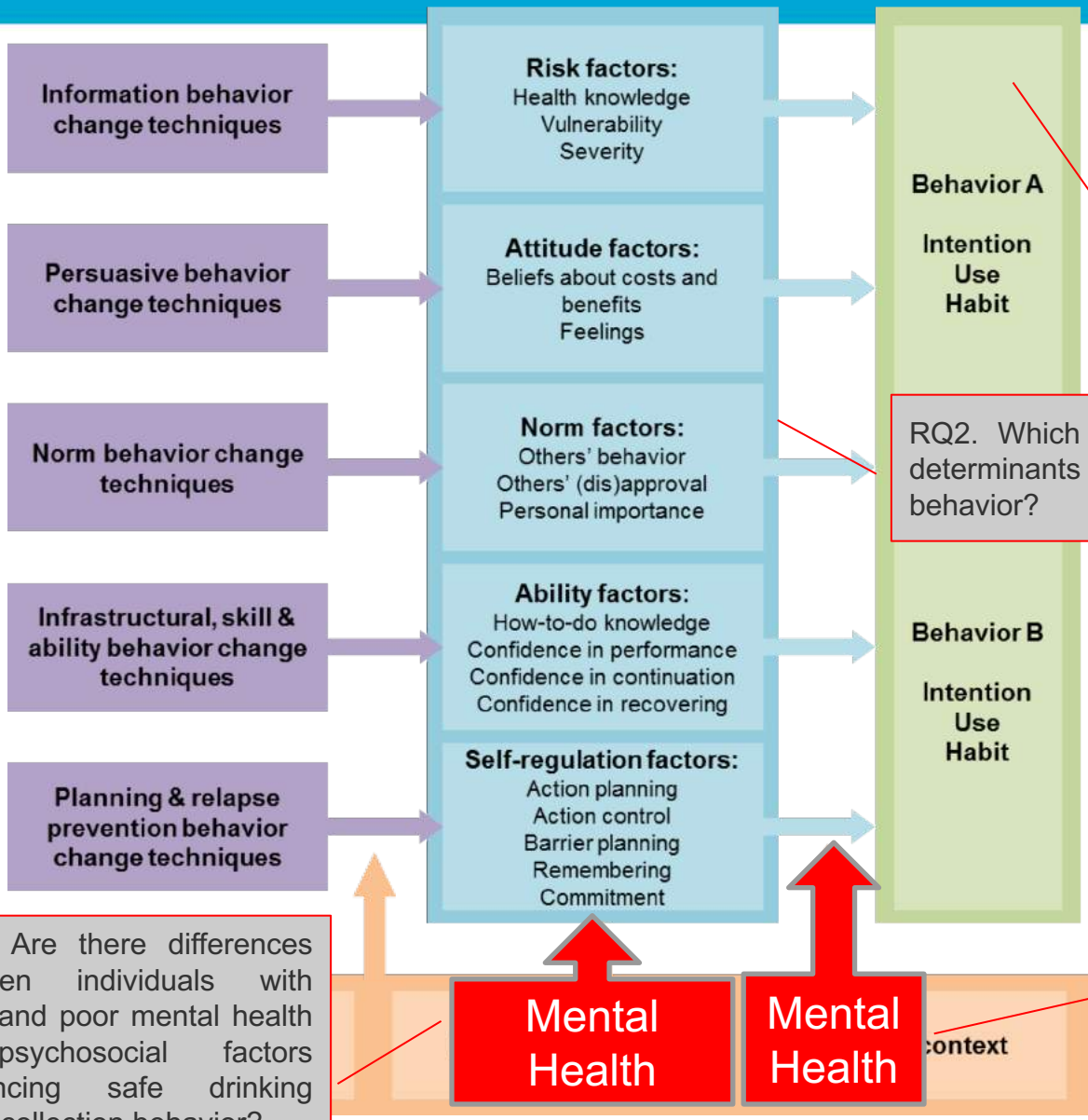
- WASH behaviors are daily activities that require effort, time, and strong internal motivation.

The RANAS-Model: Risk, Attitudes, Norms, Ability and Self-regulation



Mosler, H.J., (2012). A systematic approach to behavior change interventions for the water and sanitation sector in developing countries: a conceptual model, a review, and a guideline. International Journal of Environmental Health Research, 22 (5), 431-449.

The RANAS-Model: Risk, Attitudes, Norms, Ability and Self-regulation



RQ1. Is there a relationship between mental health and WASH-related behaviors: a) latrine construction; b) handwashing with soap at key times; and c) safe drinking water collection behavior?

RQ2. Which psychosocial factors are behavioral determinants for the safe drinking water collection behavior?

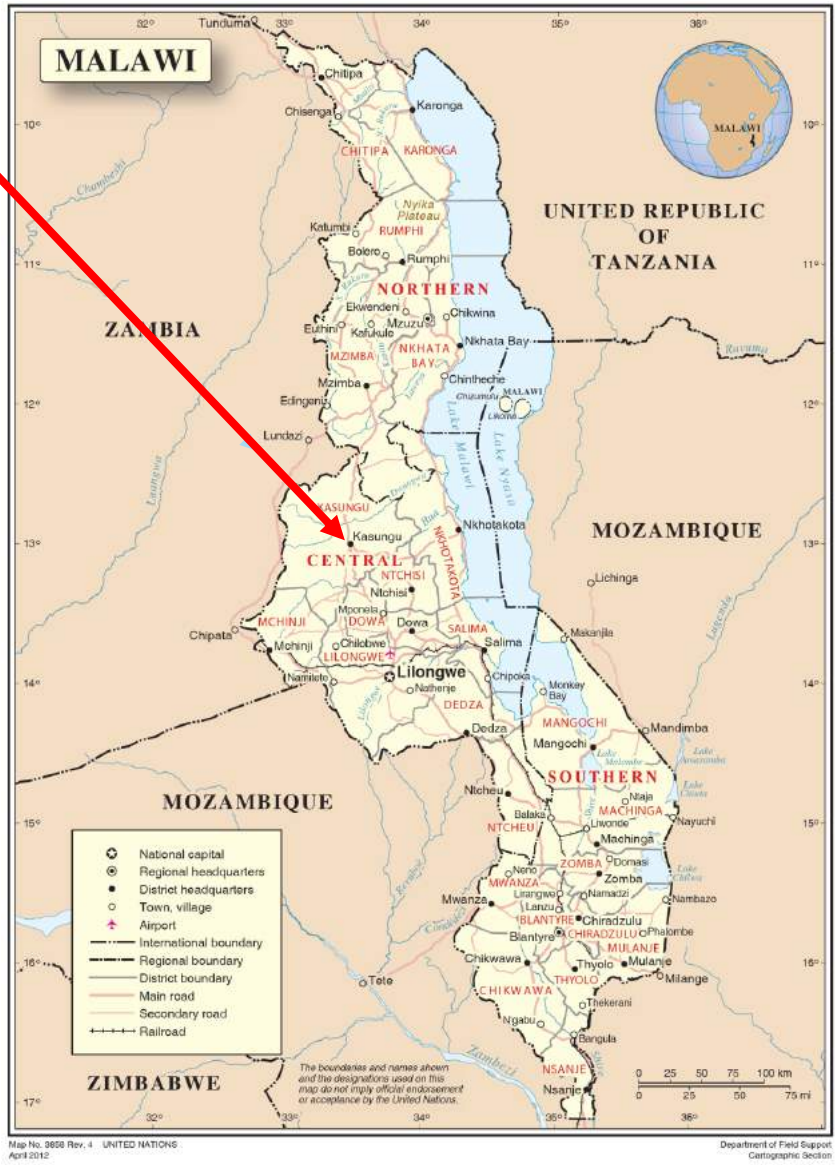
RQ3. Does mental health moderate safe drinking water collection behavior?

RQ4. Are there differences between individuals with good and poor mental health in psychosocial factors influencing safe drinking water collection behavior?

Study area: Malawi, Kasungu (Kapelula)

Malawi‘s vulnerability due to:

- Poverty
- Hunger, lack of drinking water and food
- Poor water, sanitation and hygiene conditions in many communities
- High prevalence of mental disorders (29.9%) and depression (30.3%) (Stewart et al., 2008; Udedi, 2014)



Methods: procedure and sample

- A quantitative survey with 641 households
- Structured face-to-face interviews in a local language (Chichewa) on tablet devises
- A quantitative questionnaire based on the RANAS approach to measure WASH behaviors and psychosocial factors
- Mental health assessment using the validated Chichewa version of the self-reporting questionnaire (SRQ-20, WHO, 1994)
- Selection of households using random-route method

Results: mental health and WASH behaviors

Mental health: 26.8% of respondents scored ≥ 7 on the SRQ-20 scale (suggested cutoff point ≥7 for impaired mental health).

Significant negative associations between mental health and

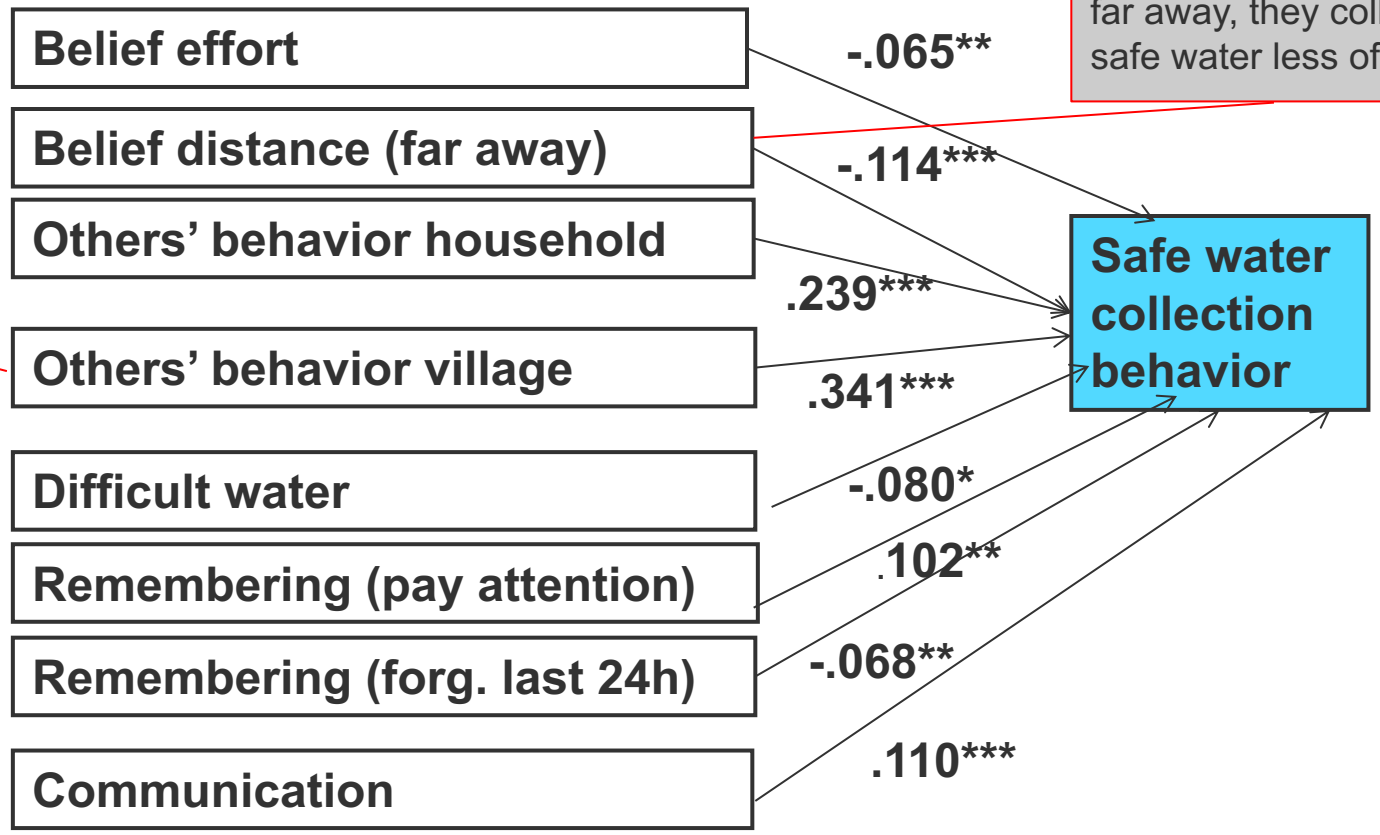
- **latrine ownership** (observed!) (p =.01, r =−.171)
- **handwashing with soap** (p =.01, r =−.106)
- **safe drinking water collection** (p =.01, r =−.104)

Results

The most important predictors for safe water collection behavio

E.g. if people think that a lot of others in village collect safe drinking water, they also collect more safe water.

E.g. if people perceive that the water point is far away, they collect safe water less often.



Note. *p ≤ .05, **p ≤ .01, ***p ≤ .001. Adj. R^2=.746, *N*=621

Results: moderation

Interaction effects between Mental Health and RANAS psychosocial factors on self-reported safe drinking water collection behavior

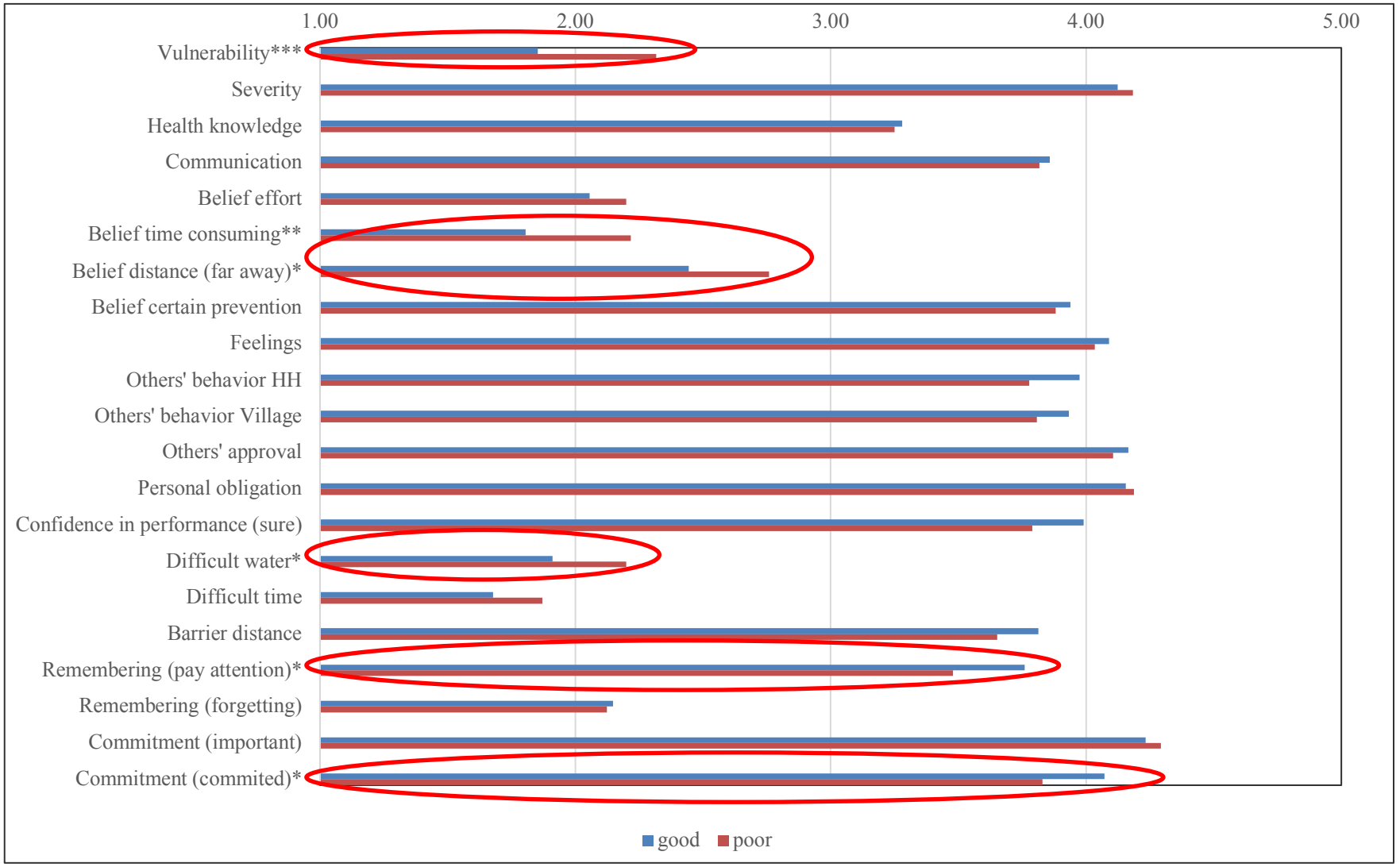
E.g. The relationship between forgetting and water collection is significantly more impaired by poor mental health condition!

E.g. The relationship between paying attention and water collection is significant stronger in people with poor mental health!

Interactions with Mental Health	*b*, 95% CL	*t*	Conditional effects at values of Mental Health	
			1=poor	0=good
Others' behavior village	.100* [.062, .194]	2.09	.927***	.827***
Remembering (pay attention)	.153* [.015, .291]	2.17	.749***	.596***
Remembering (forgetting last 24h)	.178* [–.335, –.023]	–2.24	–.613***	–.435***
Commitment (important)	–.250* [–.475, –.025]	–2.18	–.316***	–.067

Results: differences in RANAS factors

ANOVA mean comparison of RANAS psychosocial factors explaining safe drinking water collection behavior by Mental Health condition (good vs poor).



Conclusions and practical implications

- This study investigated direct and indirect links between mental health and WASH behaviors.

- The results can be used
  - to decide which WASH interventions should be implemented with the whole population and which should be tailored to people with poor mental health.

- These results imply
  - that populations in emergency contexts and with a significant proportion of individuals with poor mental health will benefit from interventions focusing on mental health implemented before or parallel to behavioral change interventions for WASH.

- There is evidence
  - that specific population-level interventions (e.g. narrative exposure therapy – NET, Neuner et al., 2008; or group based interpersonal therapy – IPT-G, Gwozdziewycz & Mehl-Madrona, 2013) have a positive effect on mental health, and they have been successfully applied at scale in African settings.

Eawag:
Swiss Federal Institute of Aquatic Science and Technology

eawag
aquatic research

Thank you for your attention!!!

Mental health in emergency contexts: Does poor mental health impair WASH-related behaviors in a vulnerable population of rural Malawi?

Jurgita Slekiene & Hans-Joachim Mosler

Belgian
Red Cross
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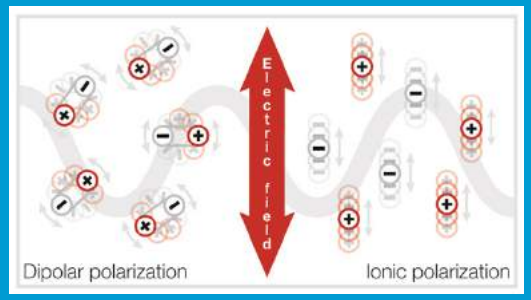
Integrated mobile approach for faecal and septic sludge treatment, reuse and disposal using microwave irradiation

Improving WASH for urban settings under stress of migrants



C.M. (Tineke) Hooijmans
IHE-Delft, The Netherlands

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مياهنا
miyahuna

Eva Kocbek

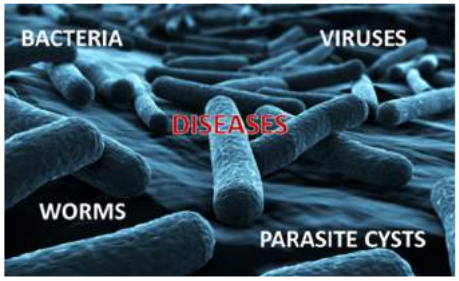
Peter Mawioo

UNESCO IHE DELFT

Funded by Ministry of Foreign Affairs of the Netherlands

Context: emergency sanitation

- Heavy usage of onsite sanitation facilities in refugee camps or cities with a high influx of refugees
- Rapid accumulation of large amounts of fresh FS in pit latrines/ septic tanks which should be frequently emptied
- FS contains large amounts of pathogens, uncontrolled disposal might jeopardize human health and pollute the scarce water resources
- SDG's: alternative technologies to fill the gap that business as usual technologies have not been able to address



www.nelsonmacneil.com

Emergency sanitation

"In many emergency situations access to adequate sanitation is one of the strongest determinants of survival. ***Unlike increased availability of emergency water supply options, only few alternatives for sanitation have been developed over the last thirty years."***

=> Need for innovation

Emergency Sanitation Workshop at U-IHE, 2012, UNHCR, IFRC, NLRC, Oxfam.

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What to do with FS to protect water resources and health?

=> Sanitization

- Pathogen inactivation; affected by heat, moisture, pH
- Liquid sludge
  - heat transfer by mixing*[1]
  - lime addition
- More solid sludge
  - heat transfer by air flow*[2]
- Especially helminth eggs are a problem to inactivate…….

=> Microwave heating technology

*[1]Norwegian and Swedish Red Cross and partners – A-Aqua: Hygieniser100 and VacuSan

*[2]LaDePa South Africa

MW based reactor system

- Microwave (MW) based reactor system for FS treatment
- Compact and portable

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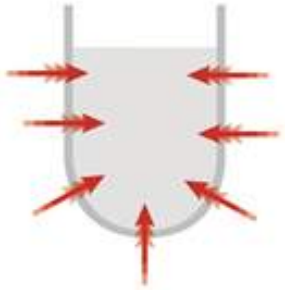
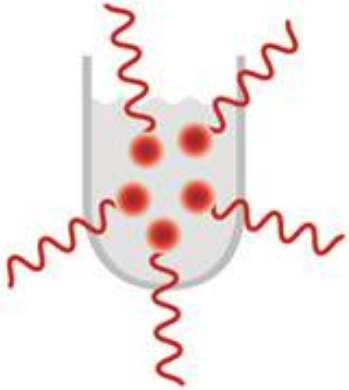
MW heating

	Heat Source	Heat Introduction	Temperature Distribution
a	Conventional heating:		
b	Microwave heating:		

http://wiki.anton-paar.com

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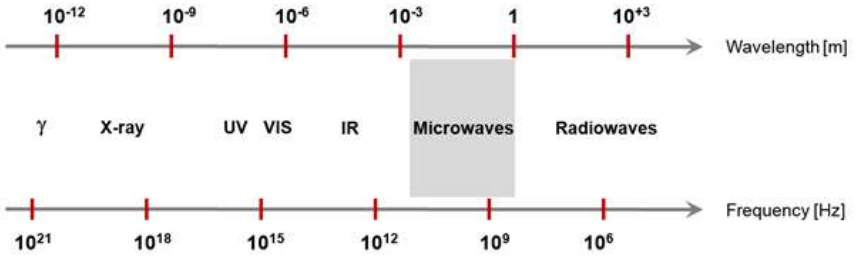
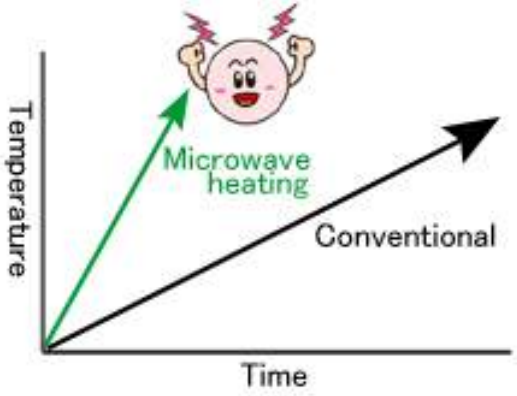
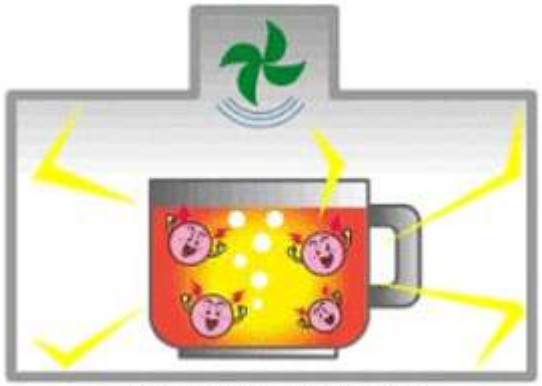
MW heating



- Electromagnetic waves generated in magnetron
- Electricity, magnets and vacuum tube -> waves travel through a metal tube to be scattered by a fan in the oven
- Internal heating -> rapid
- Selected heating -> high energy efficiency





Figures: http://www.microdenshi.co.jp/en/microwave/

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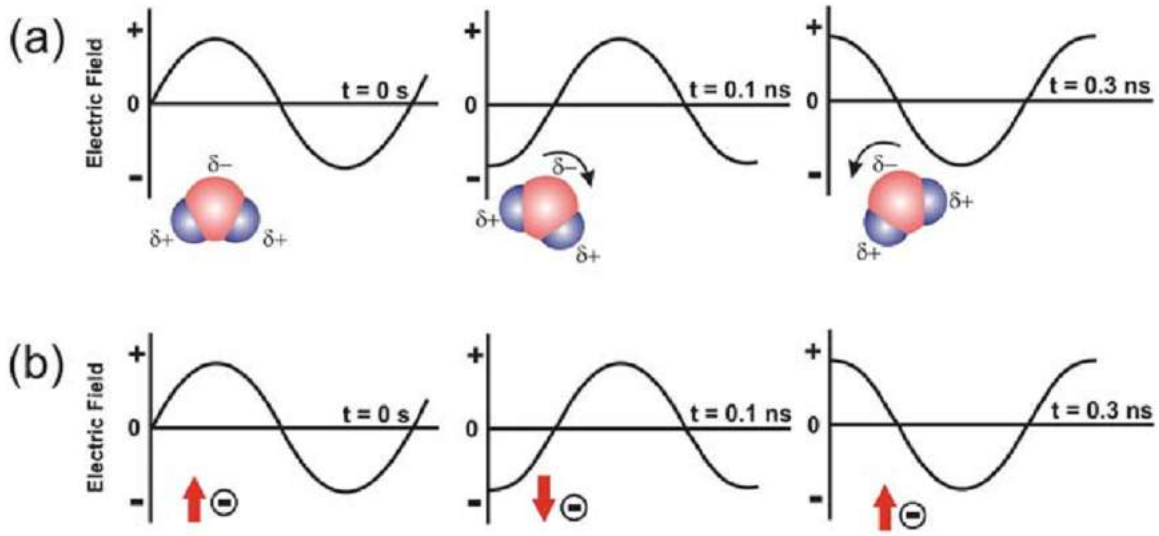
MW Dielectric Heating

1. Dipolar polarization:
    - Microwave field is oscillating, the dipoles in the field align causing rotation: heat energy
2. Ionic conduction:
    - Dissolved charged particles (usually ions) oscillate back and forth under the influence of changing electric field: heat energy

.



http://wiki.anton-paar.com More rapid heating will occur for the tap compared to distilled water

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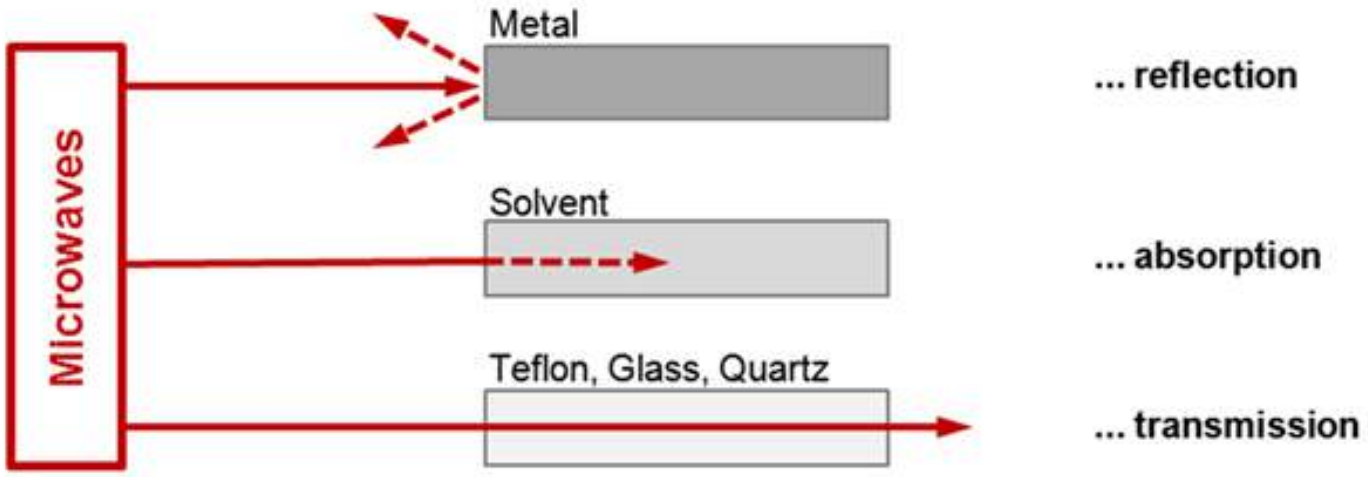
Very specific heating of material



- FS: contains high amounts of dipolar molecules such as water and organic complexes: good candidates for the MW dielectric heating
- Increased heating by blending with a (high loss) material (i.e. MW facilitator e.g. char)

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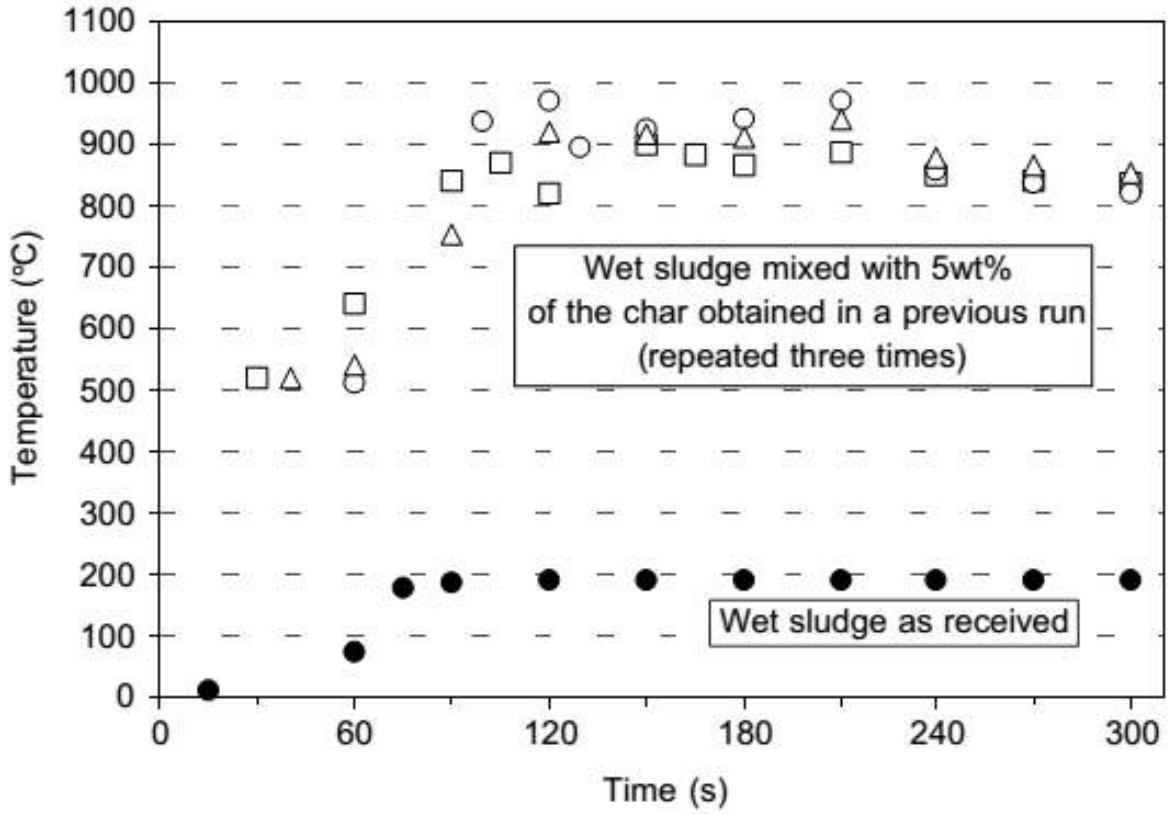
Results of laboratory tests with sewage sludge



Temperature evolution during microwave treatment of samples of wet sewage as received; and mixed with 5 wt% of the char obtained in a previous run

J.A. Menendez et.al, Fuel Processing Technology, Volume 91, Issue 1, January 2010, Pages 1–8

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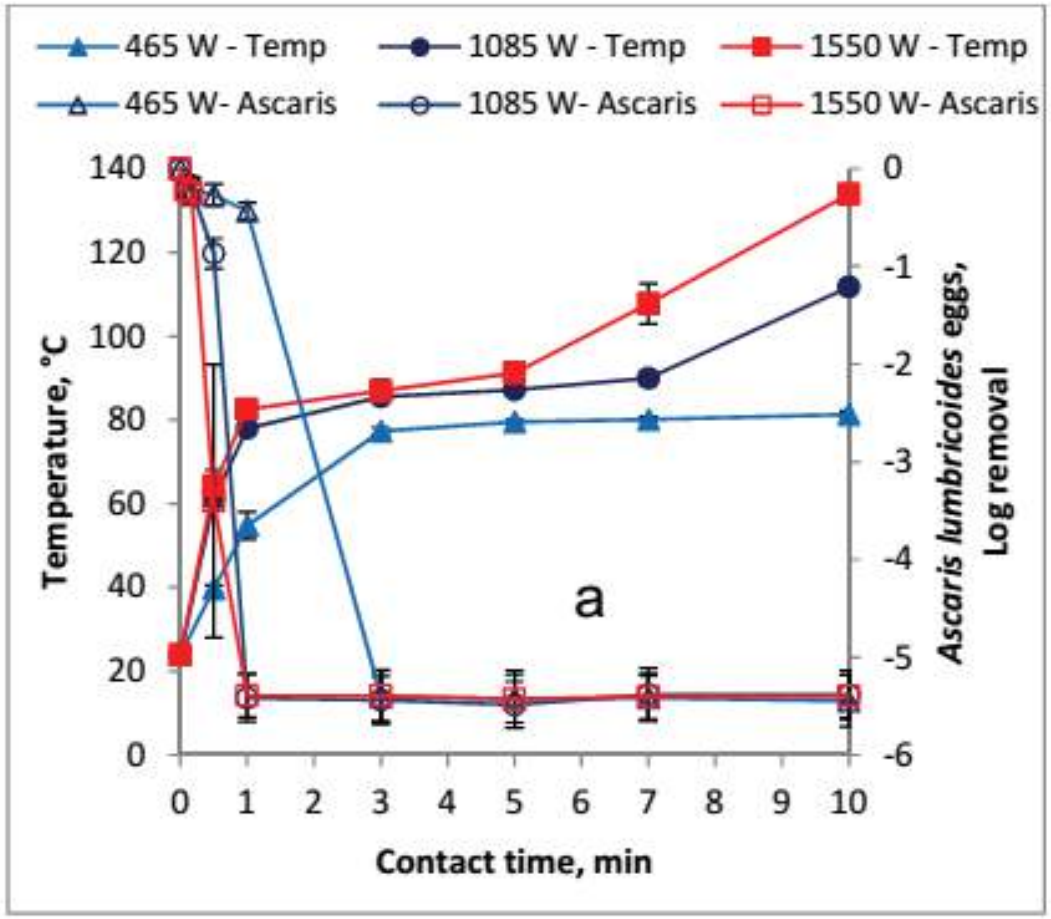
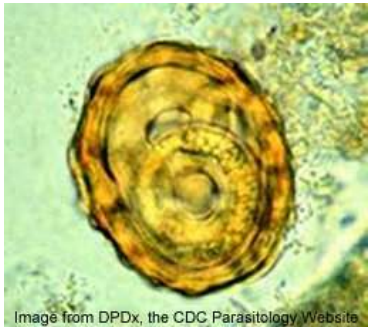
Results of laboratory tests with faecal sludge



- Rapid temperature evolution
- Pathogen inactivation
- Weight reduction

Conclusion:
Efficient way of pathogen kill off due to rapid heating, and promising for FS drying



P. Mawio et.al, Sci Tota.l Environ. 2016 Apr 1; 548-549: 72–81

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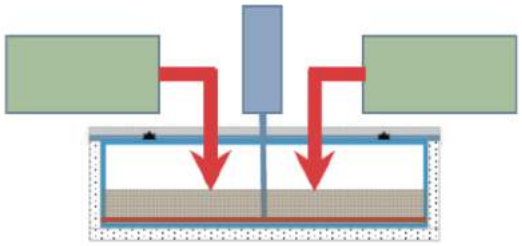
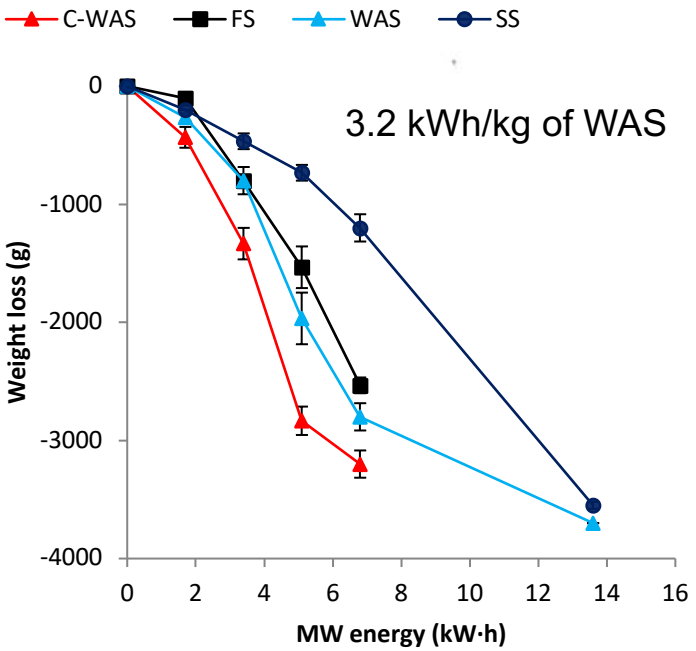
Pilot tests with various type of sludge



- Dielectric properties of sludge
- Calorific value of sludge
- Pathogenic indicators
- Specific energy consumption
- Alternative energy source



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Containerized system

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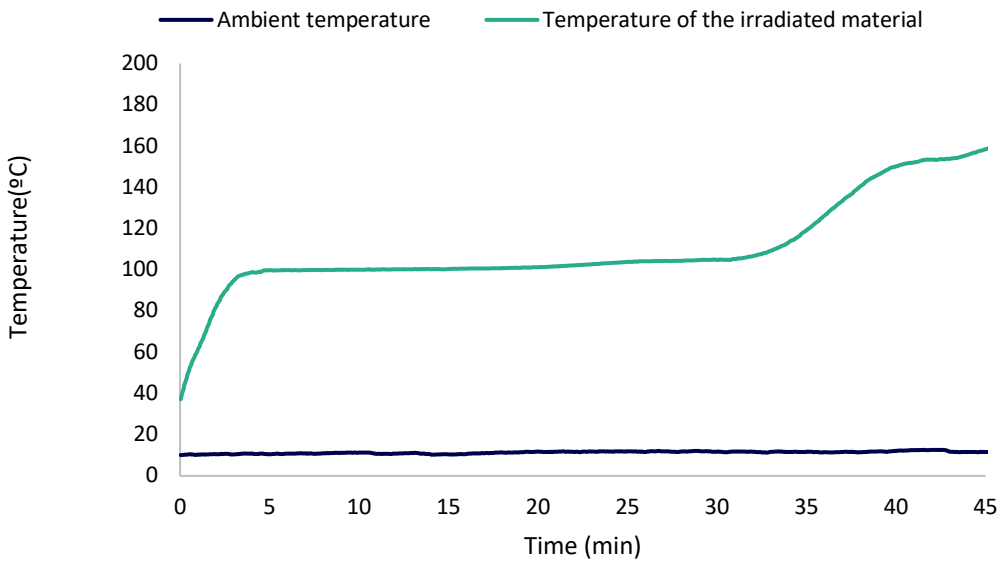
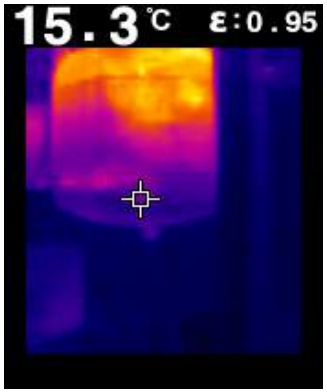
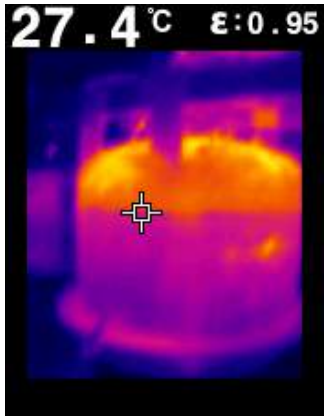
FLIR
85.5
gorenje
119
ON
OFF
TARE

Heating







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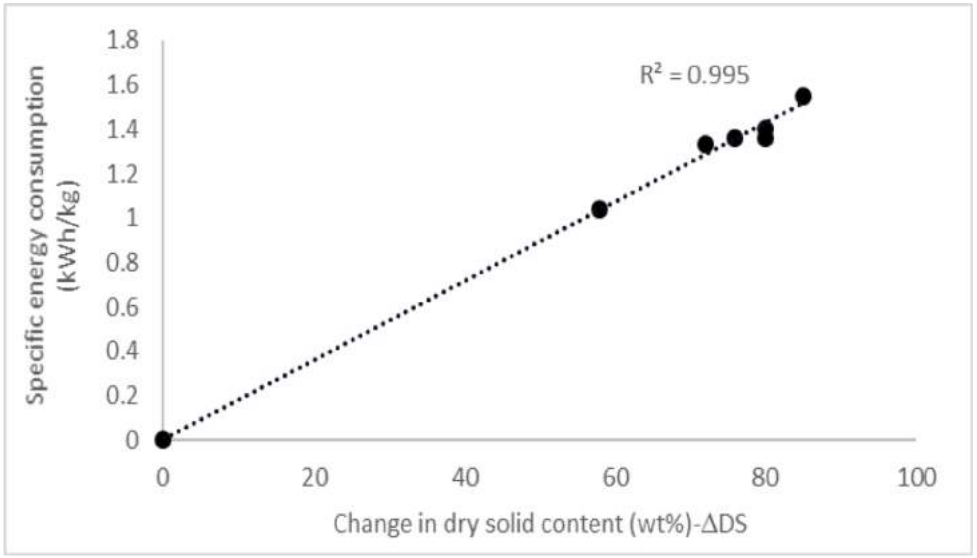
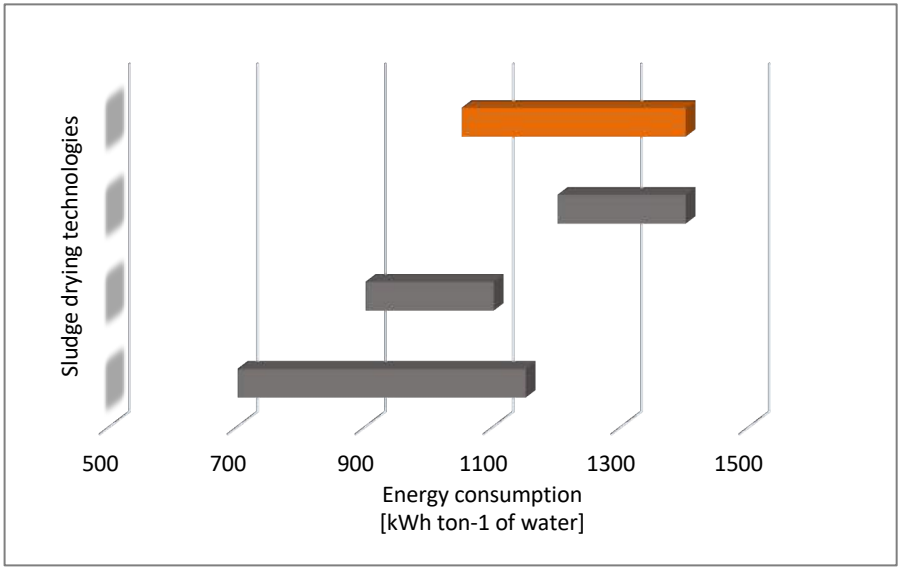
Energy consumption





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Jordan

- GJU:
  - Application of renewable energy
  - Testing of system at pilot site location (September 2018)

- WAJ:
  - Standards for wastewater, sludge reuse
  - Stakeholder involvement and perception

- Miyahuna:
  - Potential end-user: alternative technology for unique and/or dispersed situations

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مياهنا miyahuna
Hashemite Kingdom of Jordan Water Authority of Jordan
GJU الجامعة الألمانية الأردنية German Jordanian University
Funded by Ministry of Foreign Affairs of the Netherlands

Further research with focus on application in Jordan

- Further development together with partners
- Optimization of the system in Jordan
- Action research on user acceptance
- Outcome: experience and application of a promising technology to de-sludge and treat on-site FS for Jordan, increased local WASH capacity

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IHE Delft Institute for Water Education

www.un-ihe.org

UNESCO IHE DELFT



IHE Delft Institute for Water Education is the largest international graduate education institute in the field of water. The institute confers fully accredited MSc degrees and promotes PhDs.

Since 1957 the Institute has provided graduate education to more than 15,000 water professionals from over 162 countries, the vast majority from the developing world.

136 PhD fellows are currently enrolled in water-related research. The Institute carries out numerous research and institutional strengthening projects throughout the world.

Core activities

Education

IHE Delft offers a wide range of flexible, high quality, specialized educational programmes to respond to the needs of diverse clients from the water sector.

Research & Innovation

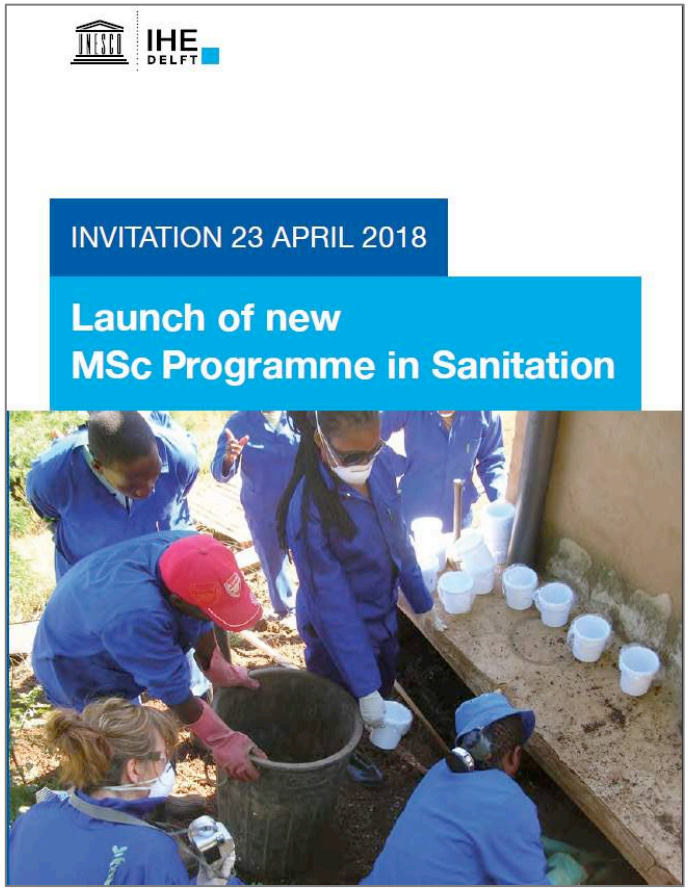
With over 139 academic staff, 136 PhD fellows and 16 post-docs active in water-related, problem-focused and solution oriented research on development issues, IHE Delft has a vibrant multicultural and multidisciplinary research atmosphere.

Institutional Strengthening

IHE Delft strives to strengthen the programmes of universities and research institutes as well as the knowledge and capacity base of ministries and other water sector organizations.

1- year MSc in Sanitation

- 2 weeks course on Emergency Sanitation
- 1 week course on Leadership



Disinfection of human excreta in emergency settings: a comparison of chlorine-based and hydrated lime-based disinfectant solutions.

Diogo Trajano Gomes da Silva, Kevin Ives, Jean-Francois Fesselet, Huw Taylor

Project background

WEST AFRICAN EBOLA VIRUS EPIDEMIC

MSF (2008), WHO (2014) and CDC (2015) WASH protocols

- Recommendation to treat Ebola patients excreta using **0.5 % CHLORINE SOLUTIONS**

- Treatment of patients excreta using **HYDRATED LIME** suspensions

Haiti 2010 cholera outbreak
Treatment of hospital wastewaters using hydrated lime

Applied Research on Disinfection to Prevent Ebola Transmission

USAID FROM THE AMERICAN PEOPLE
Applied Research on Disinfection to Prevent Ebola Transmission
Tufts University, with the University of Brighton and Brigham and Women's Hospital

Treatment of excreta using:

- **CHLORINE 0.5%** (NADCC, HTH, Bleach)
- **HYDRATED LIME** (10%, 20% and 30%)

The project

MSF Cholera guidelines (2004):
Treatment of excreta using **2% CHLORINE SOLUTIONS!!!**

University of Brighton

MEDECINS SANS FRONTIERES
DOCTORS WITHOUT BORDERS

(ARDHEES)

Applied research into the disinfection of human excreta in emergency settings using highly concentrated chlorine solutions

Aim and objectives

Project aim

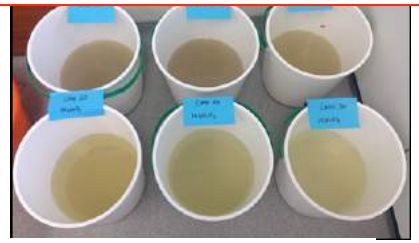
To develop human excreta disinfection protocols that can be followed by MSF WatSan response staff in emergency settings so as to minimise the risks of on-going disease transmission and to improve safe working conditions for operators.

Project Objectives

- Perform bucket-scale disinfection of human excreta using chlorine-based (0.5, 1 and 2%) and hydrated lime-based (30%) disinfectants.
- Assess overall disinfection efficacy (log reduction of bacterial and viral indicators at three contact times (Ct) and using three excreta matrices (EM))
- Compare disinfection efficacy between three contact times, namely Ct= 10 mins; Ct= 30 mins; and Ct= 60 mins.

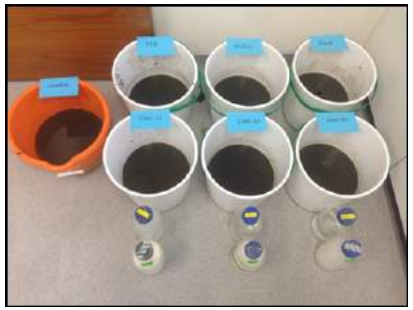
Methodology

EXCRETA MATRICES
(wastewater + faecal sludge)



0% = 4,500mL WW

10% = 4,050mL WW + 450g FS



20% = 3,600mL WW + 900g FS

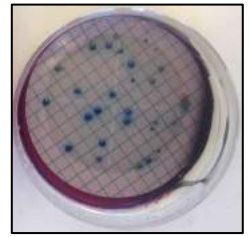
DISINFECTANTS

125 mL
Chlorine 0.5%,
Chlorine 1 %
Chlorine 2%
Lime 30%

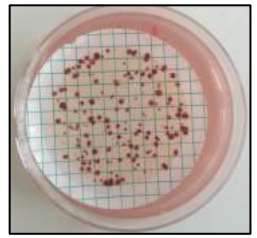
BUCKET TREATMENT

Contact time:
10, 30 and 60 minutes

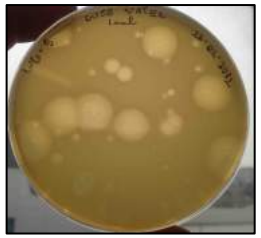
TREATMENT EFFICACCY
Log reduction of FIO



Faecal coliforms



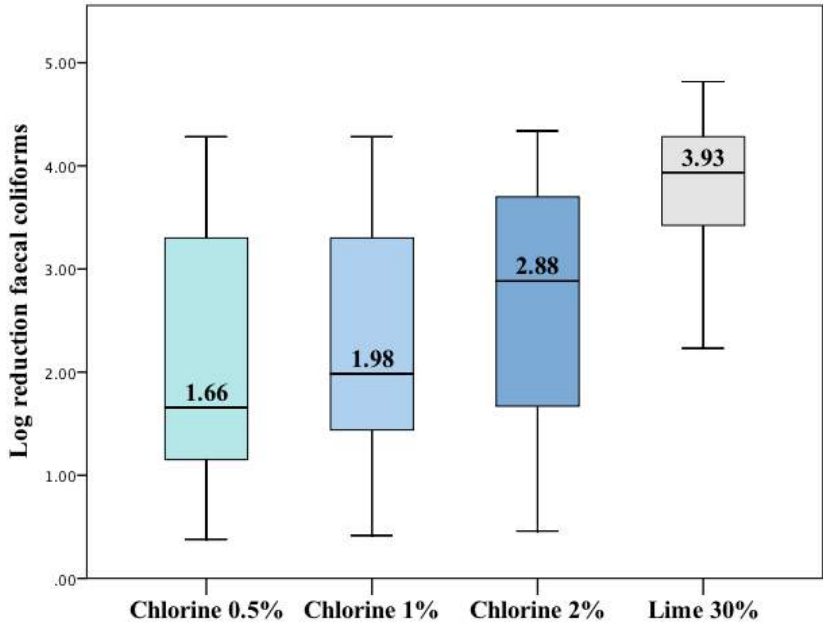
Intestinal enterococci



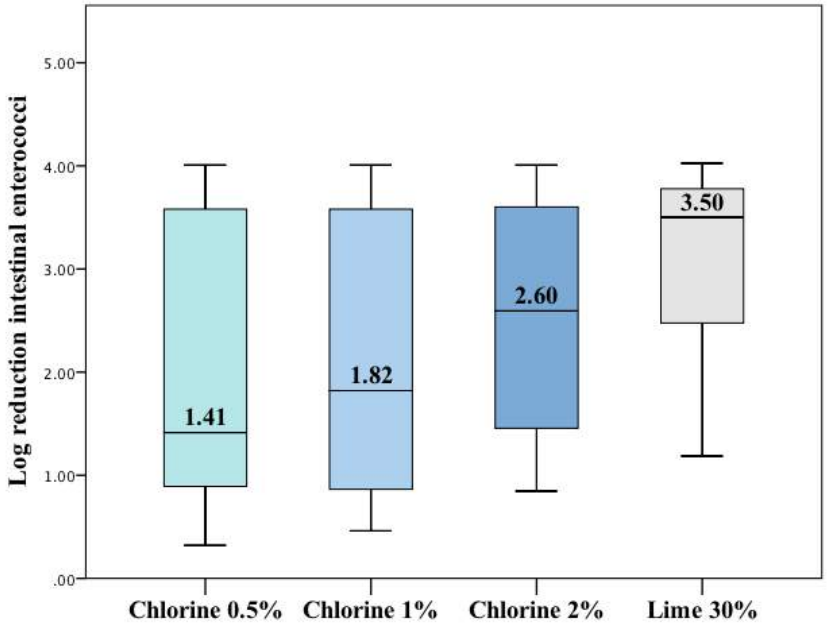
Somatic coliphages

Results: Overall treatment efficacy according to disinfectant

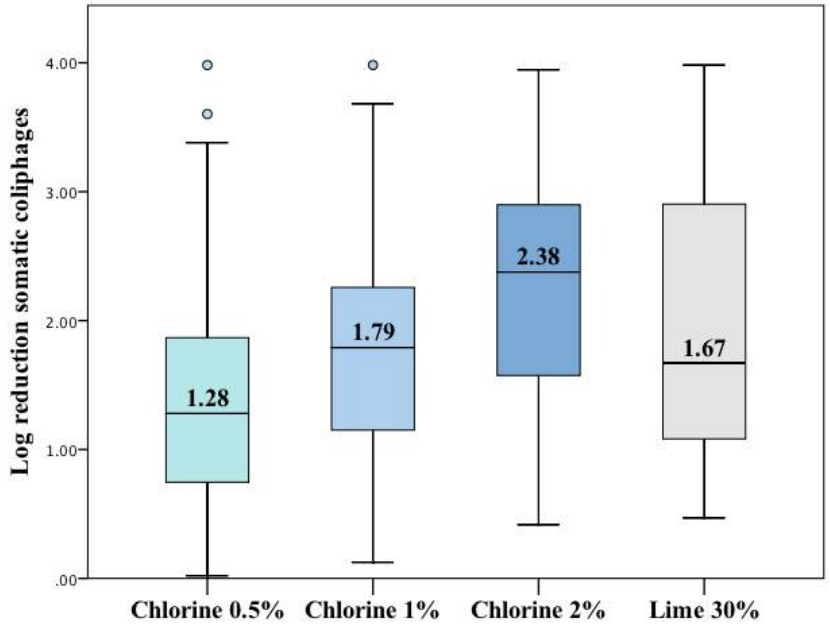
Log reduction of bacterial and viral indicator organisms



Faecal coliforms



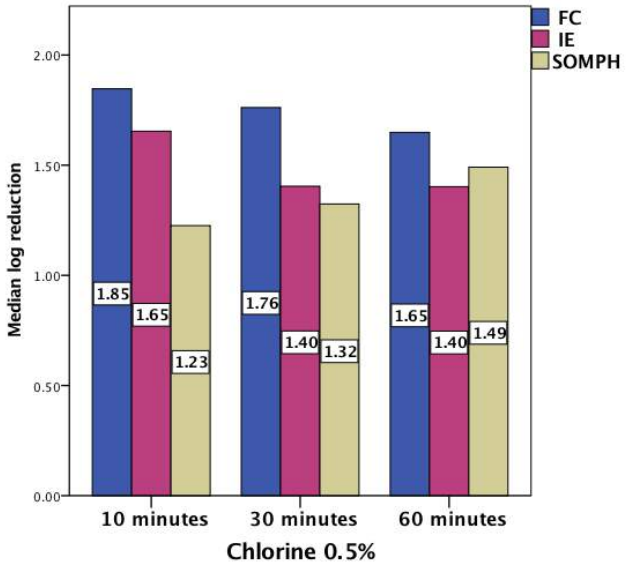
Intestinal enterococci



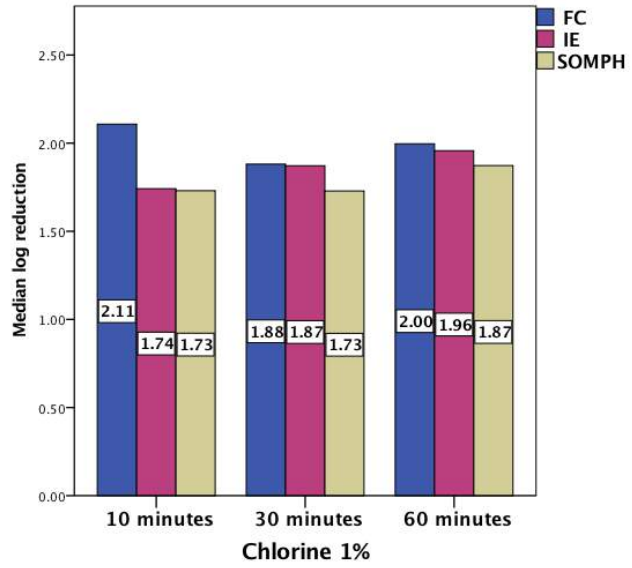
Somatic coliphages

Results: Treatment efficacy according to contact time

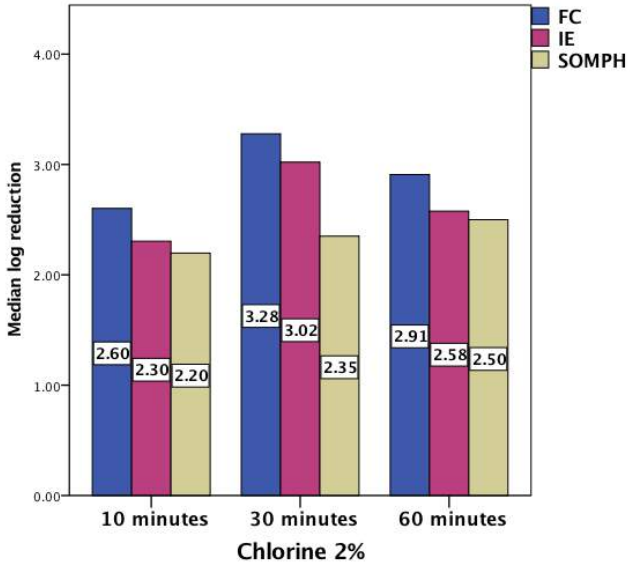
Chlorine 0.5%



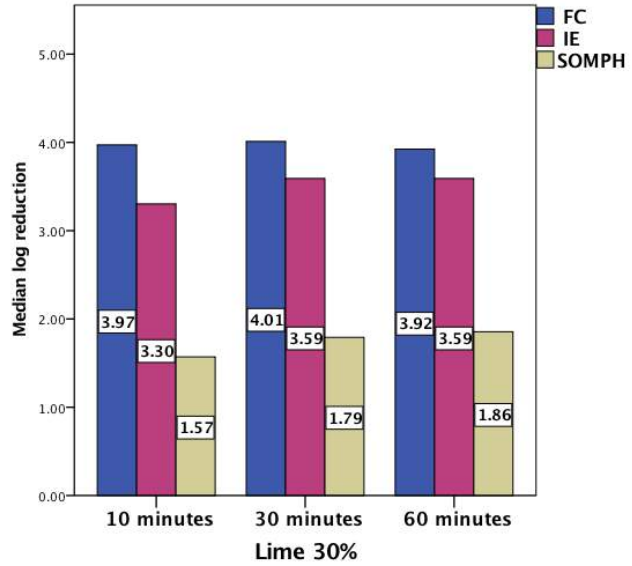
Chlorine 1%



Chlorine 2%

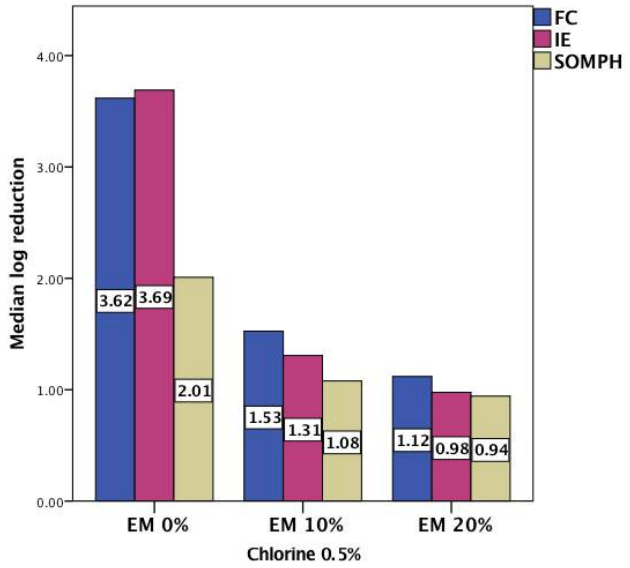


Lime 30%

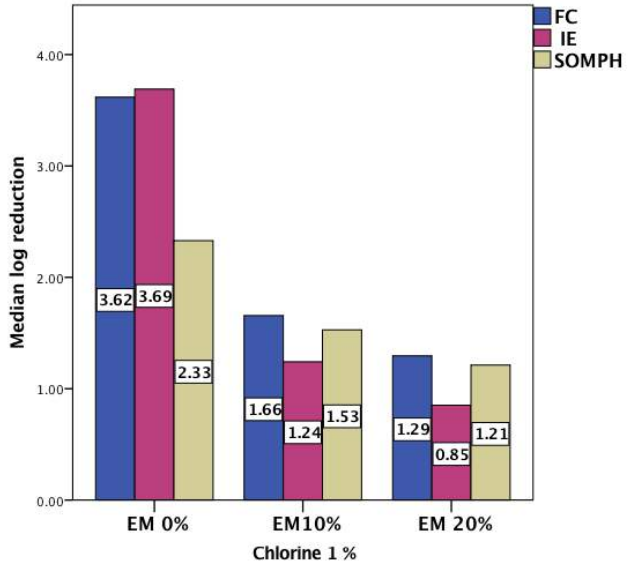


Results: treatment efficacy according to excreta matrix

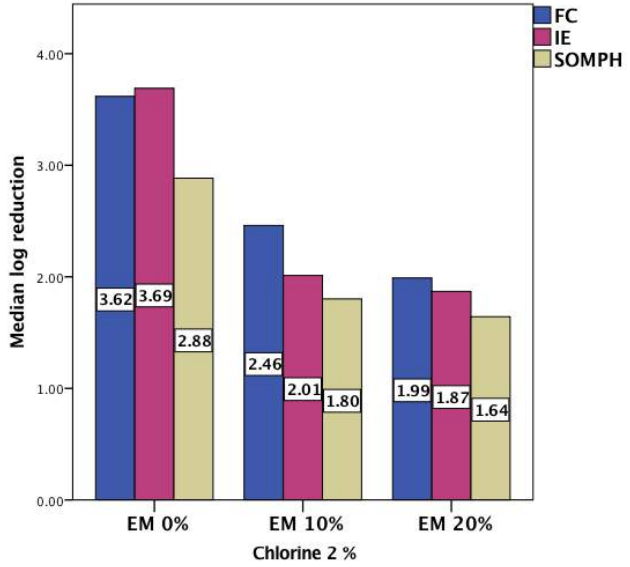
Chlorine 0.5%



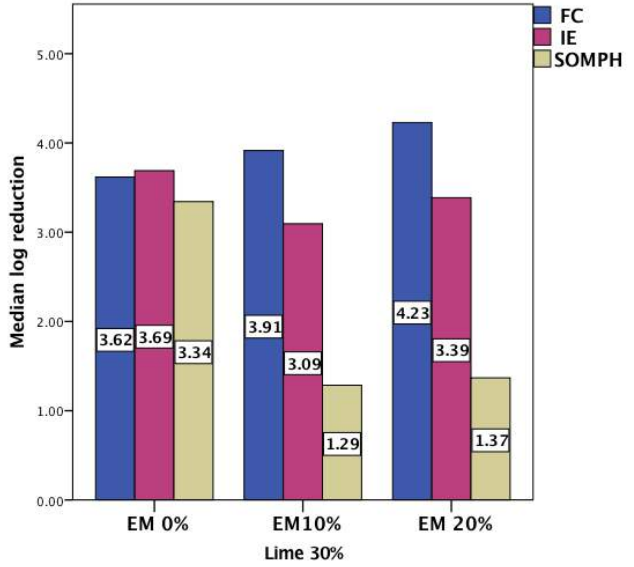
Chlorine 1%



Chlorine 2%



Lime 30%



Conclusions

- Increasing the concentration of the chlorine solution increases its ability to disinfect excreta matrices.
- Hydrated lime (HL) demonstrated greater log reductions than the traditional chlorine-based methods for two of the three enteric indicator microorganisms investigated.
- Hydrated lime suspensions achieved greater disinfection efficacy than was achieved with the chlorine solutions.
- 0.5% and 1% chlorine solutions only performed well in the ‘0% excreta matrix’ (pure wastewater).
- Contact times of 10, 30 and 60 minutes treatment efficacy not statistically significant
- 30% lime did not lose its disinfection capacity as the load of organic matter and suspended solids increased in the excreta matrices.
- Chlorine-based products appear to be considerably less effective at disinfecting more concentrated forms of human excreta containing greater concentrations of organic matter

Recommendations and future research

- To include physico-chemical disinfection using hydrated lime in emergency WASH response protocols for dealing safely with human excreta.
- To include hydrated lime in inventory lists for emergency settings.
- Where hydrated lime is not available, to use 2% chlorine solution as an emergency excreta disinfection method.
- To continue research into excreta disinfection in order to elucidate ideal excreta disinfection protocols for a variety of emergency settings.

(i.e.: larger scale treatments, regrowth of microorganisms, production of toxic gases during treatment,…)

Acknowledgements

The authors would like to thank Dr. James Ebdon, Dr. Florence Theberge, Christine Sinclair, Suzanne Armsden, (UoB), Prapamart Jackson (SW) and Southern Water (UK) for their support of this study.

Dedication : Prof. Huw Taylor

The authors would like to dedicate this report to our good friend and former collaborator Huw Taylor (Emeritus Professor of Microbial Ecology) at the University of Brighton, who sadly passed away during this project. Huw's enthusiasm and dedication was instrumental in establishing the body of research described herein. Huw dedicated his life to tackling pressing water and sanitation challenges in order to prevent the onward transmission of waterborne disease in low-resource and emergency settings.

Development of a field lab for monitoring of faecal sludge treatment plants

Microbial Sludge Quality (MSQ) Project

Johannes Bousek

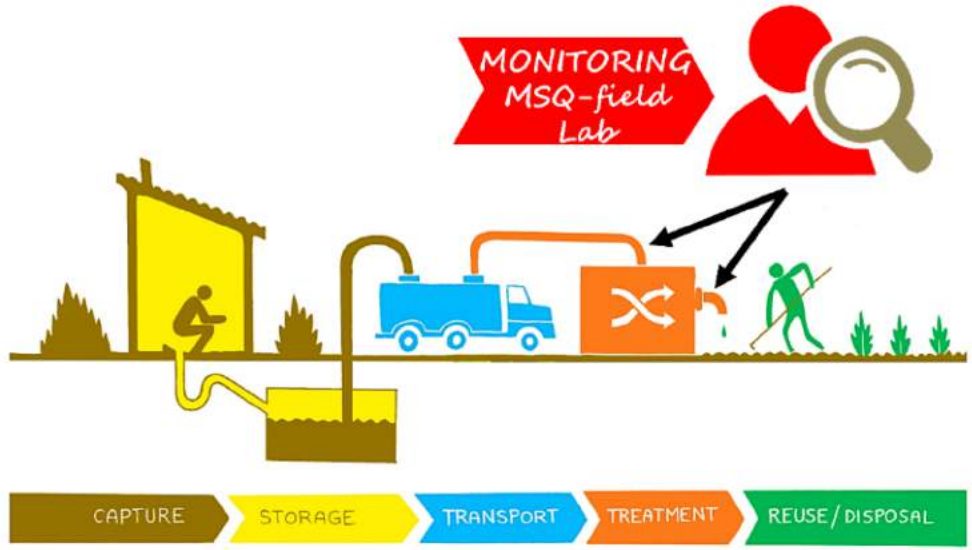
8th Emergency Environmental Health Forum
Berlin, April 12-13, 2018

Content

- Introduction
- Design criteria
- Processes & Parameters
- (Re)Development of analytical equipment
- Analytical results
- Field test
- Product development
- Results & Implications
- Steps ahead

Introduction

- Aim — Development of a field lab for faecal sludge treatment plant monitoring (on-site & close in time)
- History — AutRC & Boku were approached by IFRC/ESP II
- Funding — Humanitarian Innovation Fund Development project
- Partners — University of Natural Resources and Life Sciences, Vienna (Boku)
  Austrian Red Cross
  Waste, Nl
  Butyl Products Ltd.



Design criteria

- Target group (original) — Humanitarian Aid Organizations
- Target group (enlarged) — Social enterprises, development agencies, utility operators

- Appropriateness — comparable results to a standard lab
- Applicability — must work in the field
- Affordability — cheaper than standard solutions
- Mobility — must fit in a Toyota Landcruiser

Parameters vs. processes

- Choice of processes and parameters based on a literature review
- Overlapping parameters for several processes

- Processes
  - From “complicated” — Aerobic wastewater treatment
  - To “simple” — Lime treatment

- Parameters
  - Core elements — Bacteriology/Helminth egg detection
  - Process control — from pH to COD and TS
  - End Control — TP, TN (Addition to process control)

(Re)Development of analytical equipment

- Reasons: heavy/bulky, expensive, power „hungry“ equipment

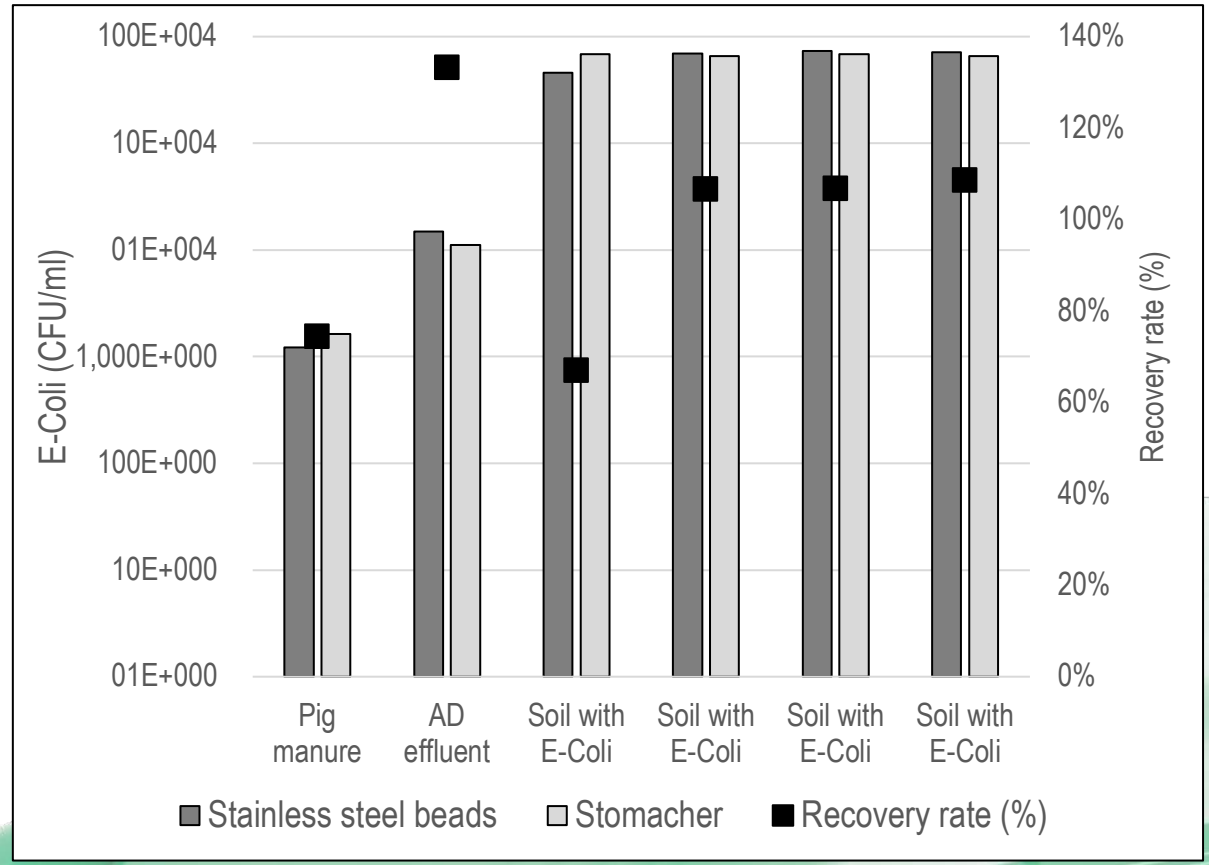
- Examples: Sample homogenization for bacteriological tests

  Sample digestion for photometric tests

  Analysis of test strips using smartphones

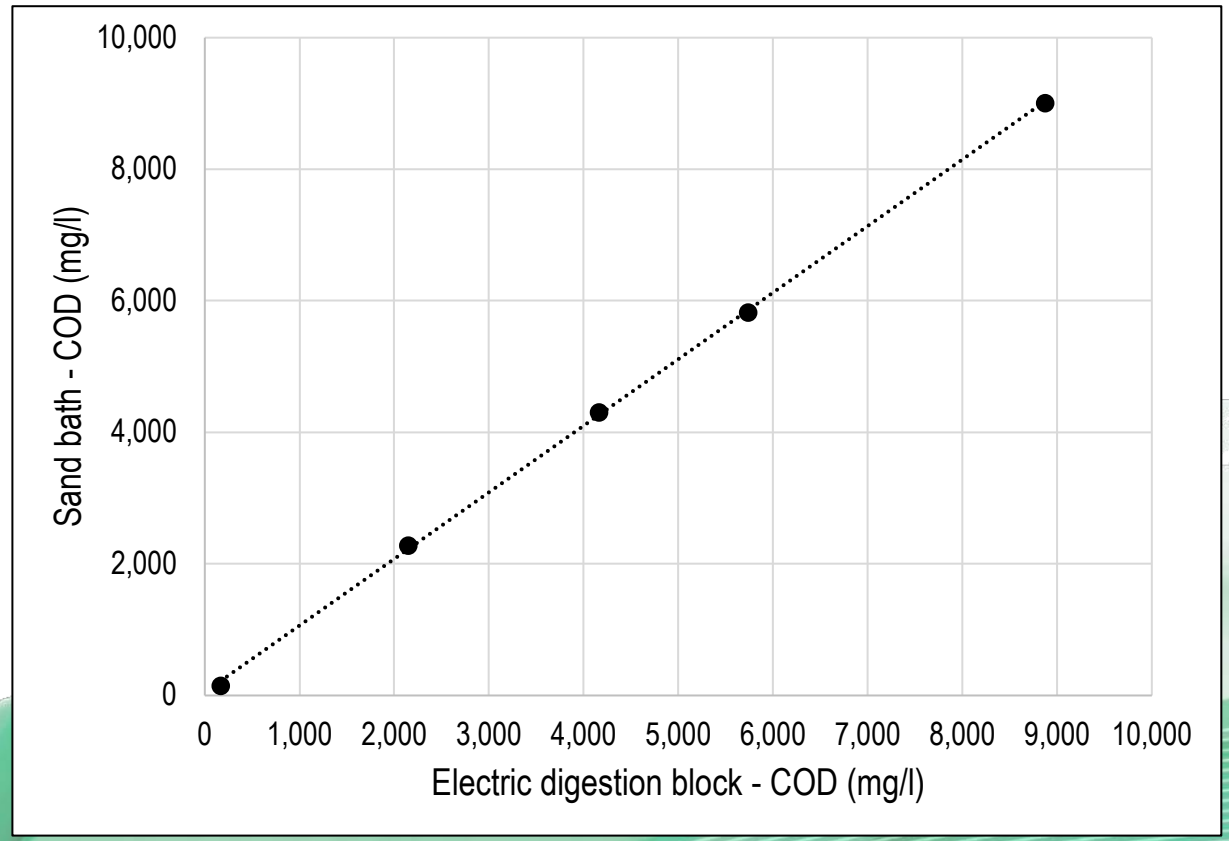
Analytical results – Bacteriology

- Standard — Stomacher/sterile blender
  Manual counting
- Field lab — Stainless steel cleaning beads
  Digital counting



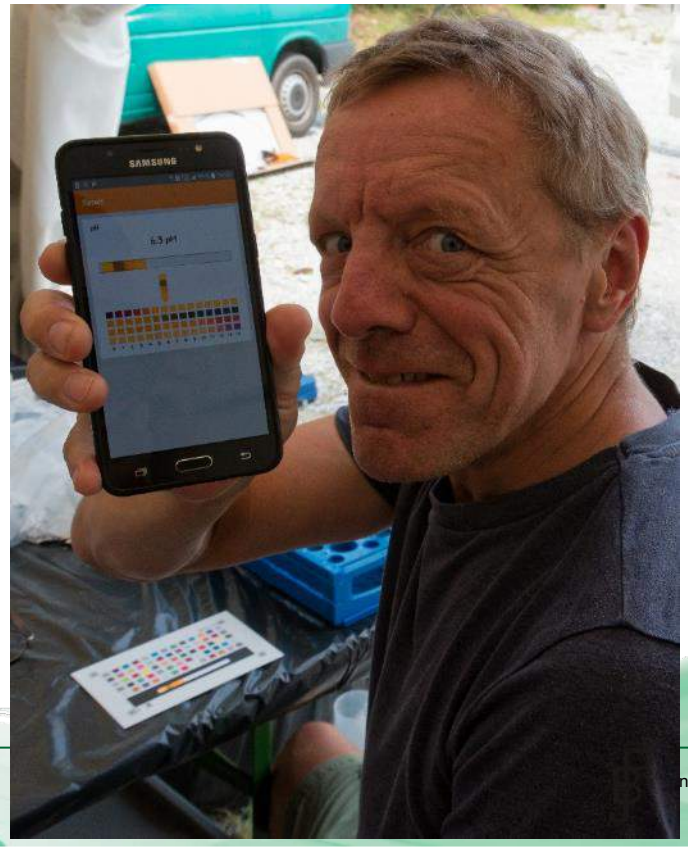
Analytical results – Chemical Oxygen Demand

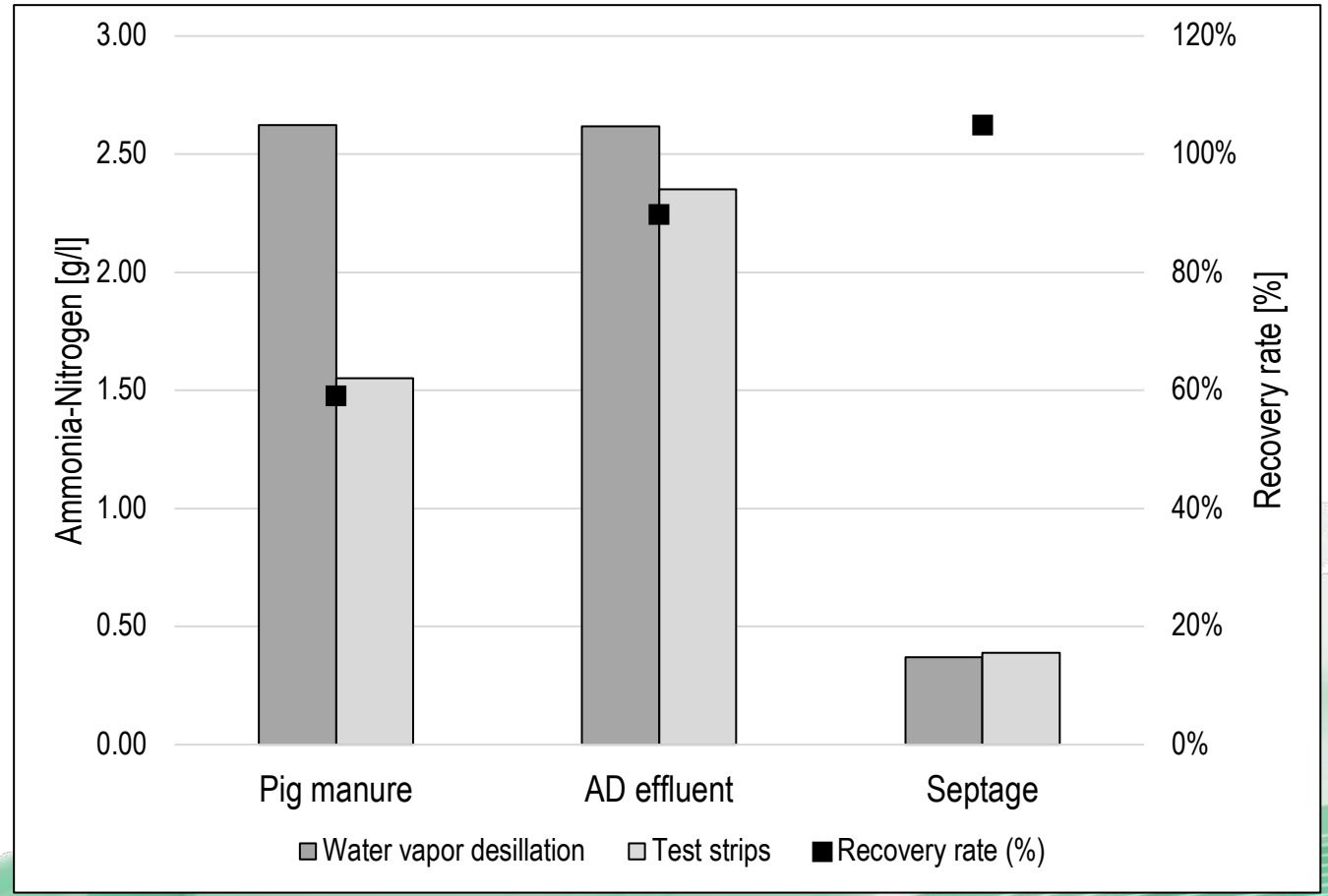
- Standard Electrical digestion block
- Field lab DIY sand bath on gas stove



Analytical results – Ammonia/test strips

- Standard — Merck test strip photometer/ photometric tests
- Field lab — AKVO Caddisfly App





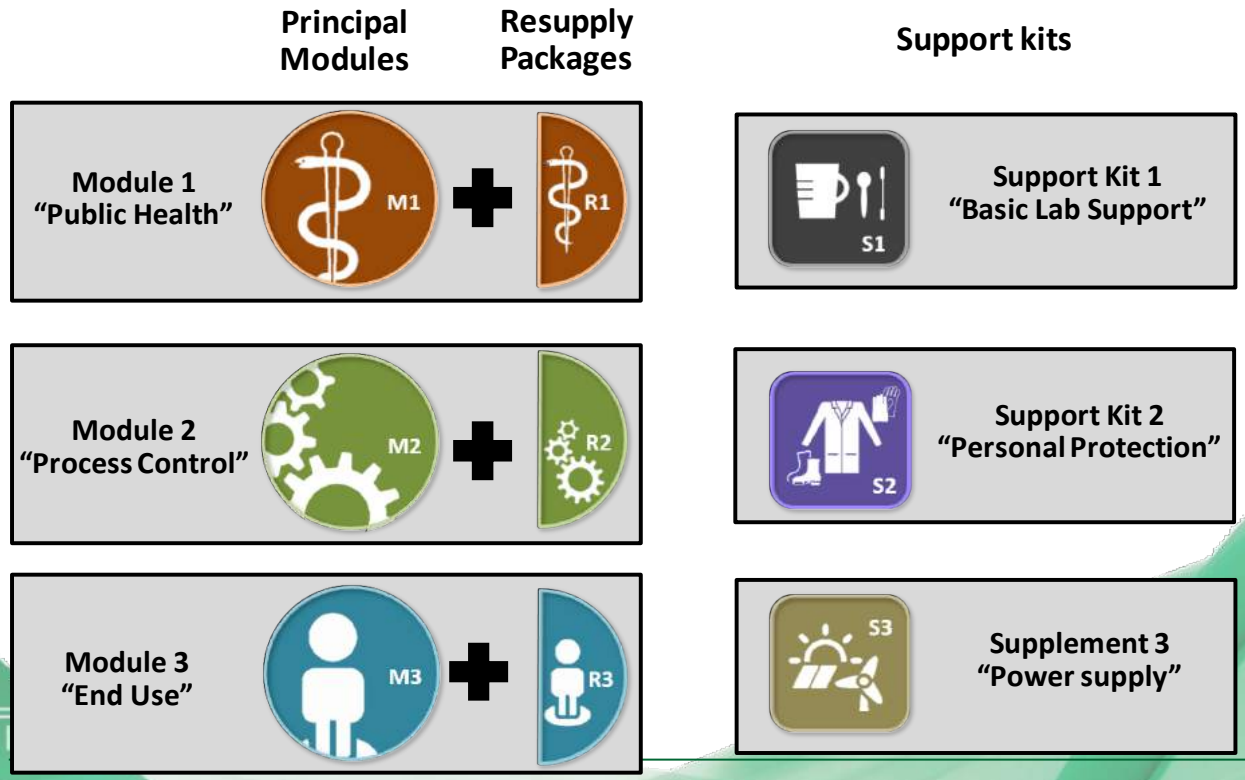
Field test - Malawi

- 1 month field trail in Blantyre, Malawi @ Waste, Malawi
- Check functionality of the field lab under field conditions
- Monitor faecal sludge/wastewater treatment plants

- Results
  - Set up fairly quick
  - Field lab was technically operational (and ongoing)
  - Monitoring of treatment plants was possible
    - No helminths in Malawi
    - Microbiology difficult (as expected)
  - Training is important and time consuming

Product development

- Modular system
  - Parameters depend on chosen process cascade
  - Modules allow customization for the operator



Anaerobic digestion

- Microbiology/Helminths
- pH/Temp
- COD
- Biogas potential
- Biogas composition
- VFA/Alk (titration)
- Total solids/Ash
- Ammonia

Lime treatment

- Microbiology/Helminths
- pH/Temp
- Total solids/Ash
- Sludge volume
- Titration for process optimization

Results & Implications

Results

- Parameter set developed
- Methods redeveloped for field use
- Functional field lab was developed
  - Lab tested
  - Field tested

- Field lab is more complex than a water lab
- Training is highly important

Implications

- Use of the lab allows on-site and close in time
  - characterization of influent & effluent
  - monitoring of faecal sludge treatment plants
  - operators to
    - run treatment plant safely
    - optimize treatment plant

Steps ahead

- 1st iteration of the lab finished
  - HIF Diffusion Project: FAST
    - Peer campaign
    - Field school
    - WASH Community Feedback

- 2nd iteration of the lab
  - Integration of feedback and operational experiences
  - “living” organism - has to evolve
    - optimization of methodology

Thank you for your attention

Johannes Bousek
University of Natural Resources and Life Sciences, Vienna
Austrian Red Cross

johannes.bousek@boku.ac.at
johannes.bousek@n.roteskreuz.at

http://www.elrha.org/map-location/microbialsludgequality-msq-field-test-kit-faecal-sludge-monitoring/

Web search: HIF & MSQ

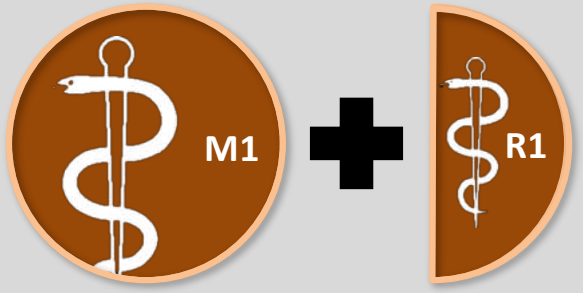
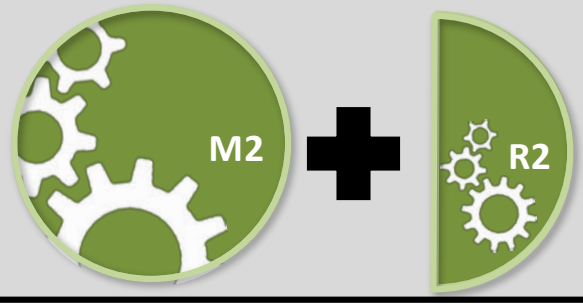
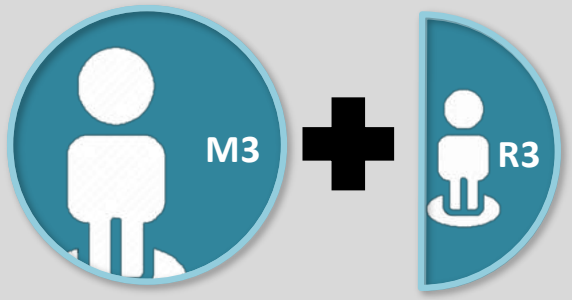
List of parameters

- pH- Value
- Temperature
- COD
- (Residual) Biogas potential
- Biogas composition
- Titration (VFA/Alk)
- Sludge volume
- Total Solids/Ash
- Soil moisture
- Ammonia
- Nitrate
- Potassium
- Total Nitrogen
- Total Phosphate
- Conductivity
- (Heavy Metals)

List of processes

- Anaerobic digestion
- Aerobic wastewater treatment
- Lime treatment
- Urea/Ammonia treatment
- Lactic acid fermentation
- Vermicomposting
- Solar drying
- Thermal drying and palletization
- Black soldier fly treatment
- Mechanical FS treatment
- Imhoff tank
- Sludge incineration
- Co-treatment in waste stabilization ponds

Description of modules (1)

Module 1 "Public Health"		Ensuring public health is of utmost importance in faecal sludge treatment, especially in emergencies. The "Public Health" module is considered as the core of the field lab. This module supplies equipment for the determination of degradation levels of indicator organisms through out faecal sludge treatment plants.
Module 2 "Process Control"		This module provides equipment for process monitoring of treatment plants. In emergency aid operations, where the treatment cascade beforehand is often unknown, the full board of equipment should be included. In non-emergency cases, the supplied equipment/parameters is adjusted to the specific treatment cascade.
Module 3 "End Use"		This module provides equipment for evaluation of treatment plant effluent streams for possible end use options. This module is not thought for emergency scenarios. In non-emergency cases, the supplied equipment/parameters is adjusted to the specific chosen end-use option.

Description of modules (2)

Support Kit 1
“Basic Lab Support”

The Basic lab support will allow operation of the lab out of the box and includes everything needed to set up and operate a laboratory in the field or in a garage. The equipment rages from a gas stove to pipettes, a fridge and a small scale water filtration system.

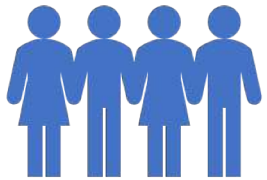
Support Kit 2
“Personal Protection”

The Personal Protective Equipment (PPE) module supplies safety materials for lab technicians and includes the PPE needed to safely work in a laboratory and take samples from faecal sludge/waste water treatment plants. For some consumables (e.g. gloves), a starting package will be provided in this module.

Supplement 3
“Power supply”

The power supply module enables the operation of the lab in an environment with unreliable power supply. The heart piece of the module is a power converter (incl. UPS), using car batteries. To allow (partial) independence from the grid, a solar panel and a wind turbine are used to recharge batteries.

Community engagement in public health



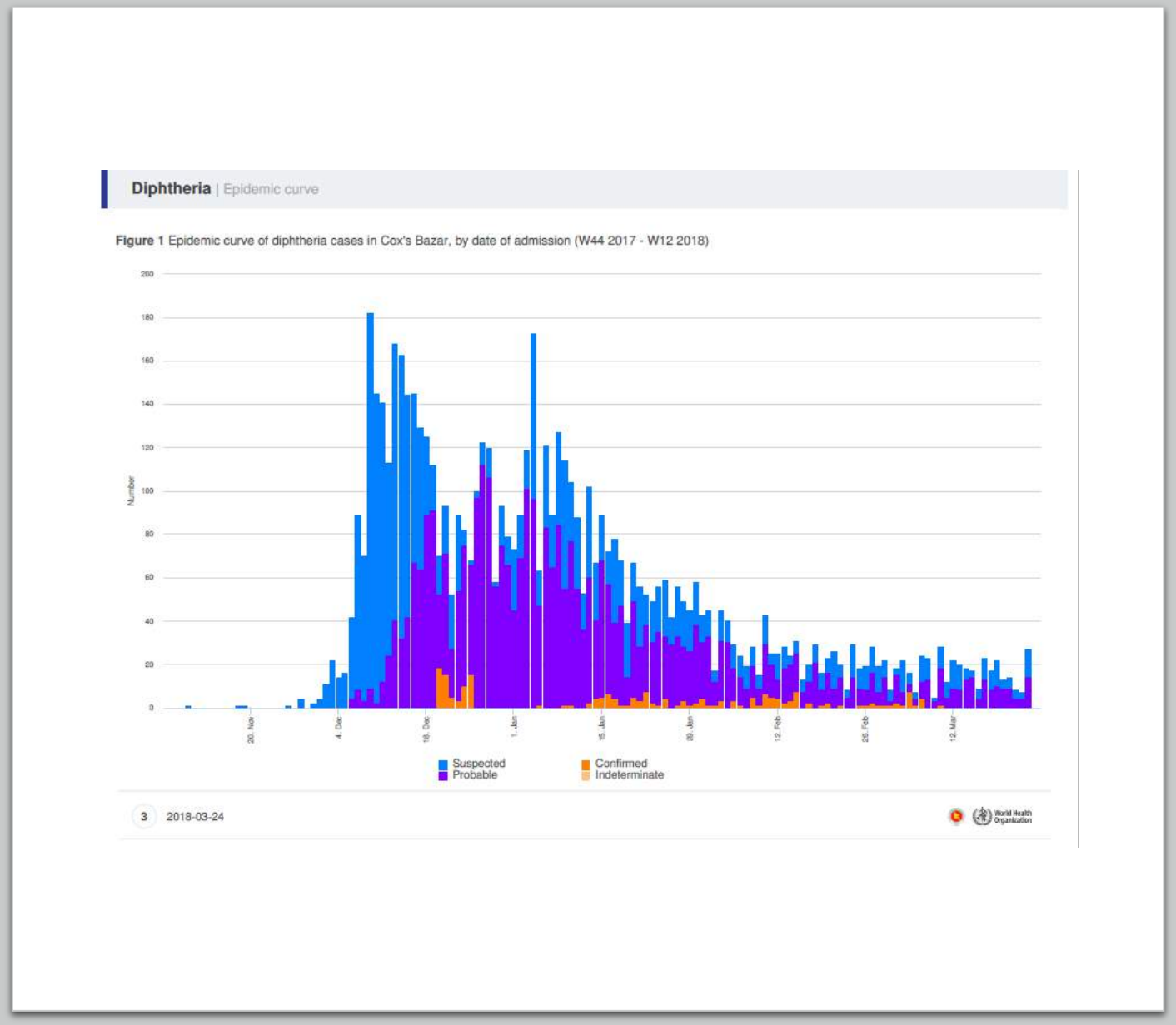
Oxfam's response to the diphtheria outbreak in the Rohingya refugee crisis, Cox's Bazar 2017-2018

Eva NIEDERBERGER,
Public Health Promotion – Community Engagement
Oxfam - Global Humanitarian Team
eva.niederberger@oxfam.org

Oxfam

Overview

- First diphtheria case: 8th November 2017
- **Total of 6460 diphtheria cases** reported - total number of **cumulative deaths 40** (week 10/2018)
- Steady increase of vaccination coverage across 3 rounds
- Contact Tracing continues to improve: out of 3,603 case patients 2,559 households traced (week 10/2018)



Oxfam

Community Engagement Process

- Orientation of Community Based Volunteers
- Identification of community level influencers (stakeholders)
- Mapping health seeking behaviors
- Development of priority action points
- Regular debriefing and follow-up

Why is this not business as usual?

Conventional WoW

- Use of didactic message based approach
- Do labour intensive door to door outreach
- Focus on knowledge transfer
- Center on leadership structures for community mobilisation

Community centred WoW

- Focus on context
- Map culturally appropriate information& communication channels
- Adopt action orientated approach
- Diversify community level interaction
- Close the feedback loop & advocate on people's people

Oxfam

Rumors and fear of vaccination

- “Better to die than getting vaccinated”
- “Vaccination will make you even become more sick”
- Vaccination will convert people into Christians
- Lack of female vaccinators
- Lack of privacy for women / girls

Consequences: home remedies, low vaccination coverage, fear

What worked well….

- Identification, involvement & building the capacity of relevant stakeholders: community based volunteers, Imams, teachers
- Working through a network of community level volunteers = confidence builders

- Understanding & supporting treatment seeking
- Mobilisation for vaccination campaign
- Coordination: timely activation, evidence based and culturally appropriate information, technical expertise

Challenges

- Initial slow uptake in the mapping of health services
- Timely production of communication materials (e.g. changing case definition)
- Harmonizing the community engagement process across multiple actors

- Building the capacity of technical staff at field level to collect the relevant information and ensure real time analysis
- Maintaining the momentum
- Scalability

Oxfam

Moving forward: community engagement in AWD preparedness & response planning

Coordination:

Harmonizing intervention strategy and capacity building approach

Context:

Epidemiological profiling, information & communication, understanding perceptions, stakeholder analysis

Working with people

Community level response planning (at scale)

FIRST PHASE WASH RESPONSE TO PLAGUE IN MADAGASCAR

8th Emergency Environmental Health Forum 12-13 April 2018

Prepared by:

ACTION CONTRE LA FAIM

In collaboration with:

MEDECINS SANS FRONTIERES

unicef

World Health Organization

Peste bubonique

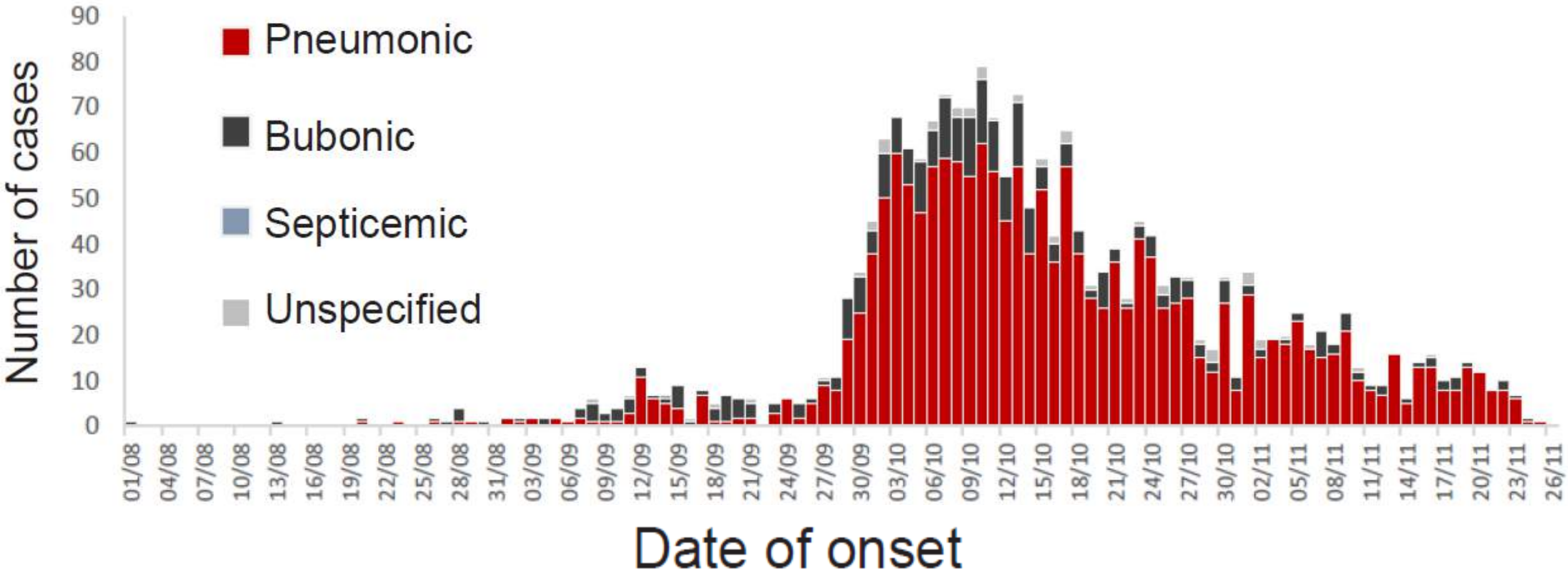
Signes cliniques de peste bubonique
grosseur douloureuse au niveau d'une aire ganglionnaire (cou, aisselle, racine de la cuisse) et sans plaies, accompagnée de fièvre

La Peste Bubonique est **transmise** par le **rat malade** de la peste via la piure d'une **puce infectée**

Peste pulmonaire

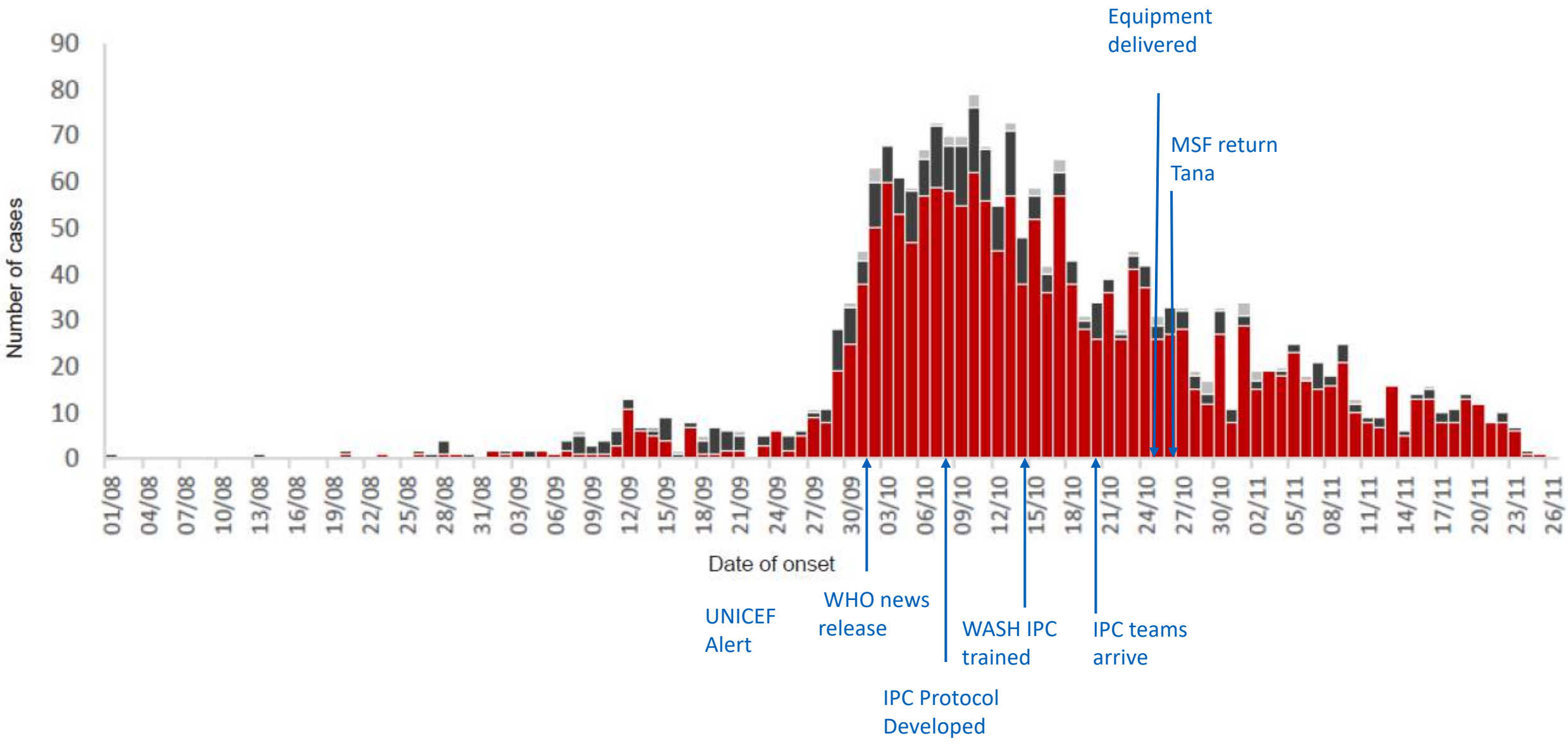
Signes cliniques de peste pulmonaire
forte toux, crachat sanguinolent, forte fièvre, douleur au niveau du thorax, difficulté à respirer

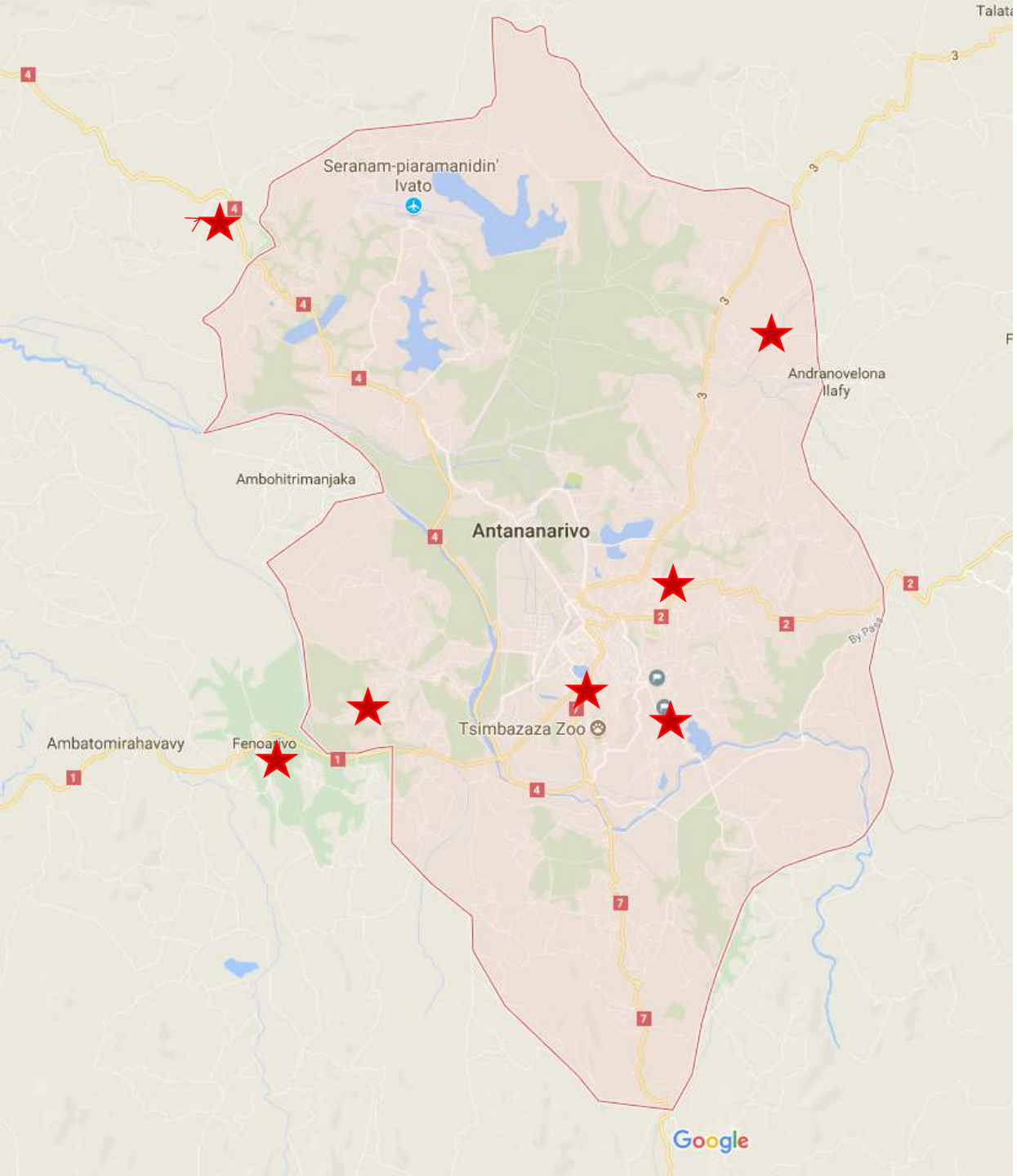
La Peste Pulmonaire est **transmise** par **inhalation** des particules émanant du malade (d'homme à homme)

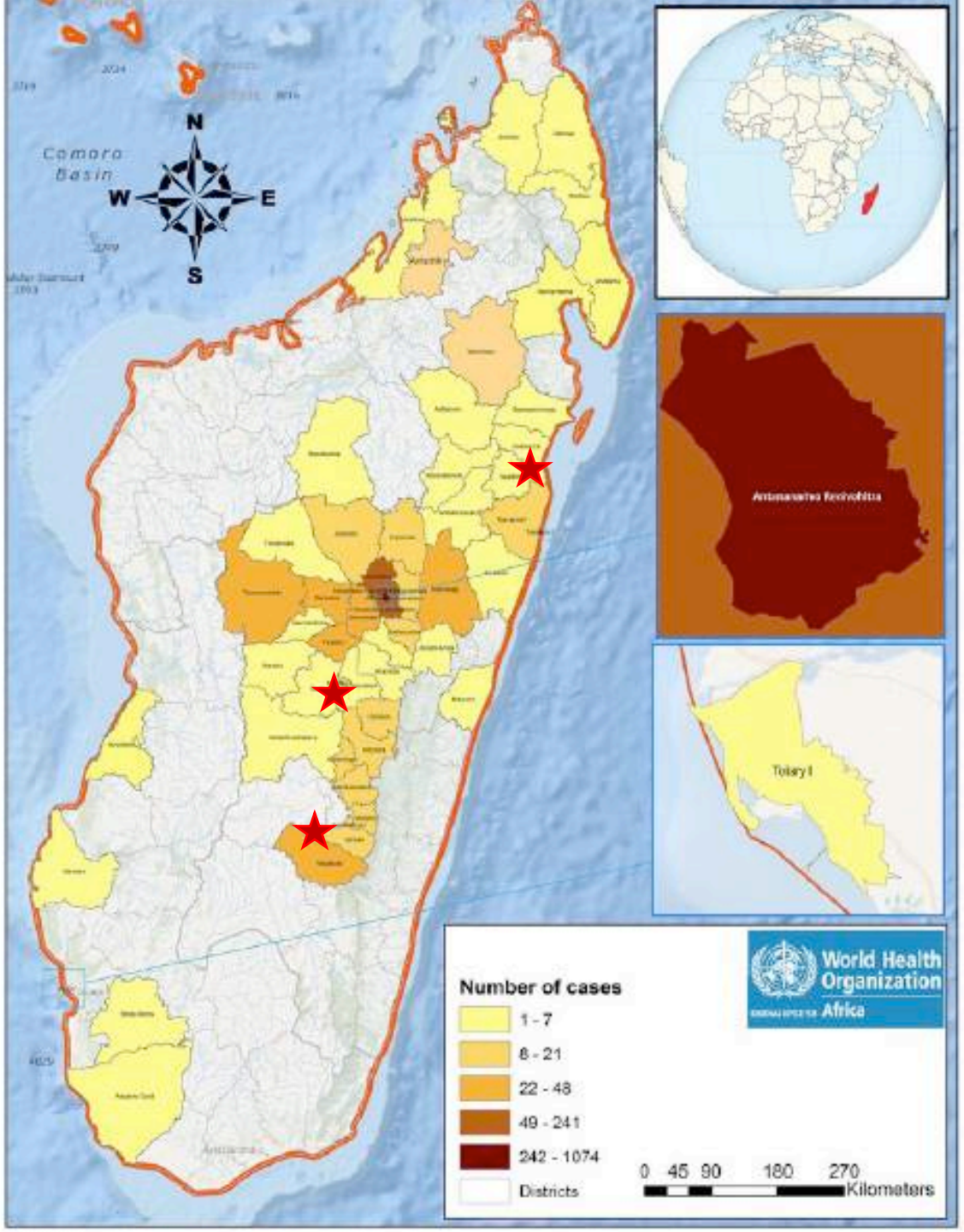


4th Dec 2018

Grade	Cases	Deaths	CFR
2	2 417	209	9%


Equipment delivered
MSF return Tana
Number of cases
90
80
70
60
50
40
30
20
10
0
01/08
04/08
07/08
10/08
13/08
16/08
19/08
22/08
25/08
28/08
31/08
03/09
06/09
09/09
12/09
15/09
18/09
21/09
24/09
27/09
30/09
03/10
06/10
09/10
12/10
15/10
18/10
21/10
24/10
27/10
30/10
02/11
05/11
08/11
11/11
14/11
17/11
20/11
23/11
26/11
Date of onset
UNICEF Alert
WHO news release
IPC Protocol Developed
WASH IPC trained
IPC teams arrive


Seranam-piaramanidin'
Ivato
Andranovelona
Ilafy
Ambohitrimanjaka
Antananarivo
Tsimbazaza Zoo
Ambatomirahavavy
Fenoarivo
Google


Comoro
Basin
N
W
E
S
Number of cases
1 - 7
8 - 21
22 - 48
49 - 241
242 - 1074
Districts
0 45 90 180 270
Kilometers
World Health
Organization
Africa

WASH RESPONSE

- IPC/Wash limited before
- MOH Authorization
- Use of regional structures for Immediate response
- Medium term partner response
- WASH cluster – equal, collaborative exchange
- Agency staff protocols

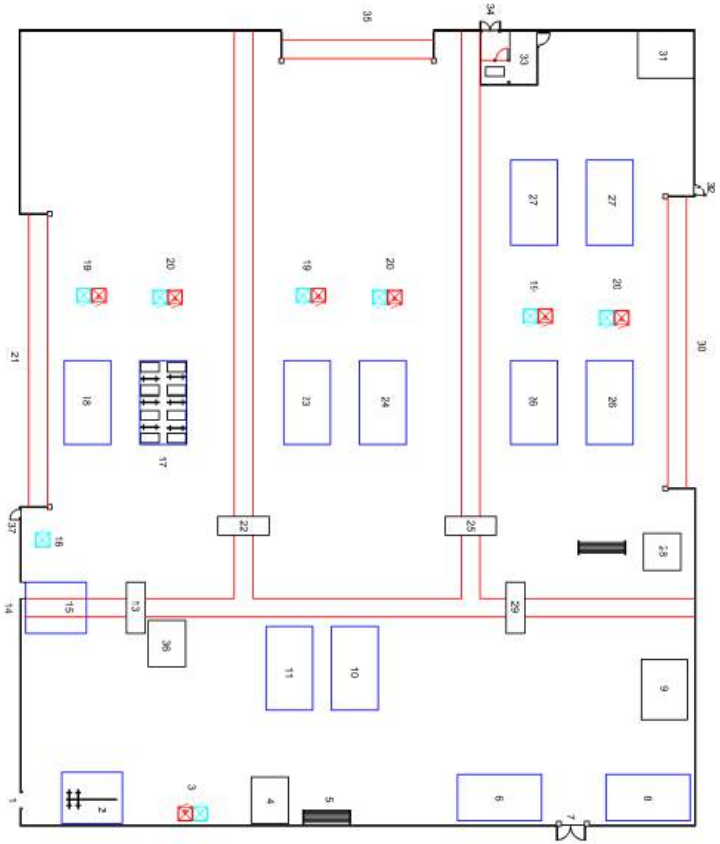
LESSON LEARNT

- Community denial
- Ebola vs cholera mind-set
- Timing of the WASH IPC teams
- IPC Protocol
  - WASH vs Triage focus
  - Coordination of IPC and hospital staff

ROLE OF MSF – TECHNICAL SUPPORT

Change in the isolation concept

From a laboratory based set up (suspect, probable and confirmed)



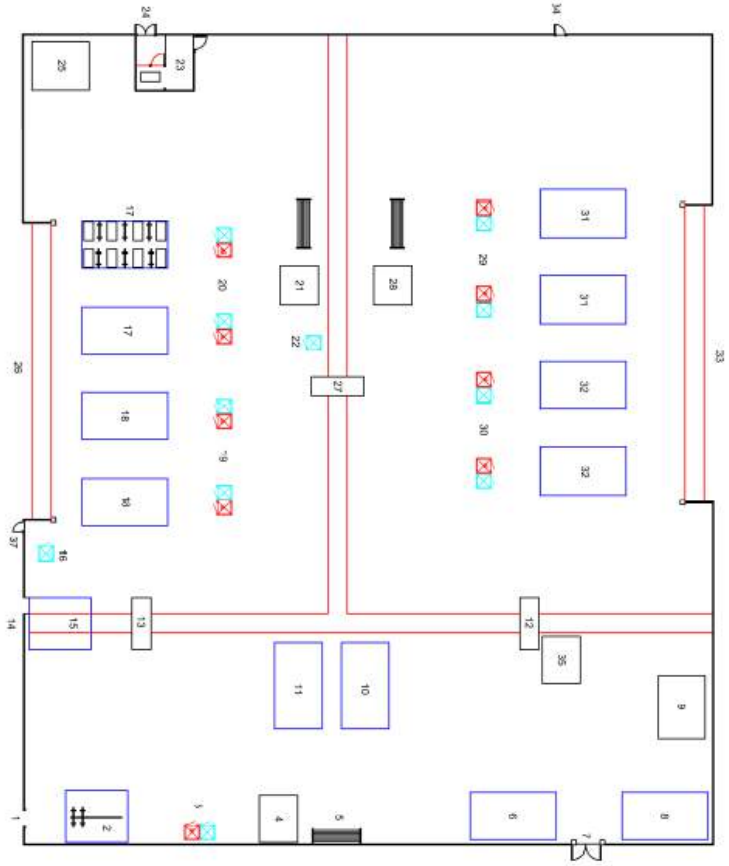
Advantage:

Simplified categorization

IPC not affected by laboratory delay

Easier implementation and set up

To a clinical based set up (infectious and convalescents)



ROLE OF MSF – TECHNICAL SUPPORT

PPE

Limited working time
Limited supply
Expensive

Adapted to specific transmission routes

Comfort

Vector control (community and CTTP)

Lack of clear and updated guidelines from WHO/CDC

Routine/epidemic measures in CTTP emphasizing

- Exclusion & sanitation
- Combination of rodenticide and insecticide to reduce risk to patients, staff and adjacent area

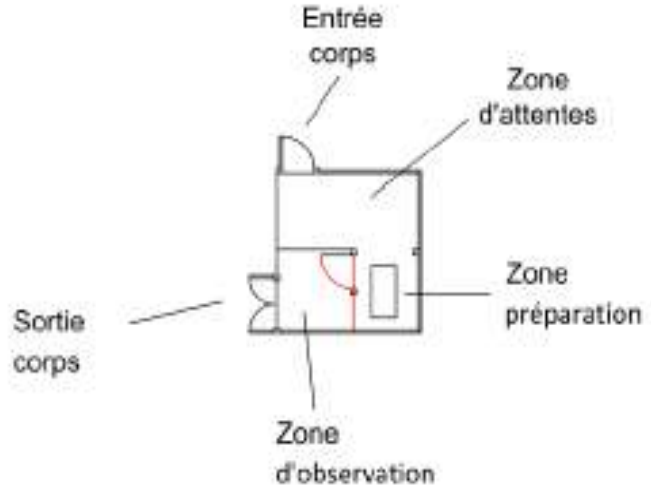
Community vector control

- Sanitation and food storage
- Restricted implementation of Vector Control in households of detected cases
- Investigation of benefits of routine vector control

Dead body

Dead body management adapted to local funeral tradition

Family/relatives involvement



LESSON LEARNT

- Health vs WASH Silos
- Rural vs Urban
- Limited epidemiology data
- Cause of outbreak decline
- Sharing of agency staff protocols
- Response Capacity

FUTURE OUTBREAKS

PLAGUE WASH RESPONSE

- Validate WASH/IPC protocol in pre agreed CTTPS with MOH partners
- WASH partners trained for future response
- Pre-agreement MOU with government for response
- Case Finding Managed by WHO/Government
- Epi Block Team and NGO networks
- Complimenting Silo working and data Gaps
- Research transmission cycle and the underlying factors Bubonic plague

OTHER DISEASE OUTBREAKS

- No Regrets / Need for Appropriate response Epidemic outbreaks in urban context:
  - Immediate humanitarian response
  - Dedicated efforts to strengthen capacity government coordination, communication and monitoring
- WASH actors support WHO/MSF/UNICEF
- WASH in IPC Positioning/Skills

Interventional Research

Effectiveness of a Household WASH Package on an Outpatient Program for Severe Acute Malnutrition: A Pragmatic Cluster-Randomized Controlled Trial in Chad

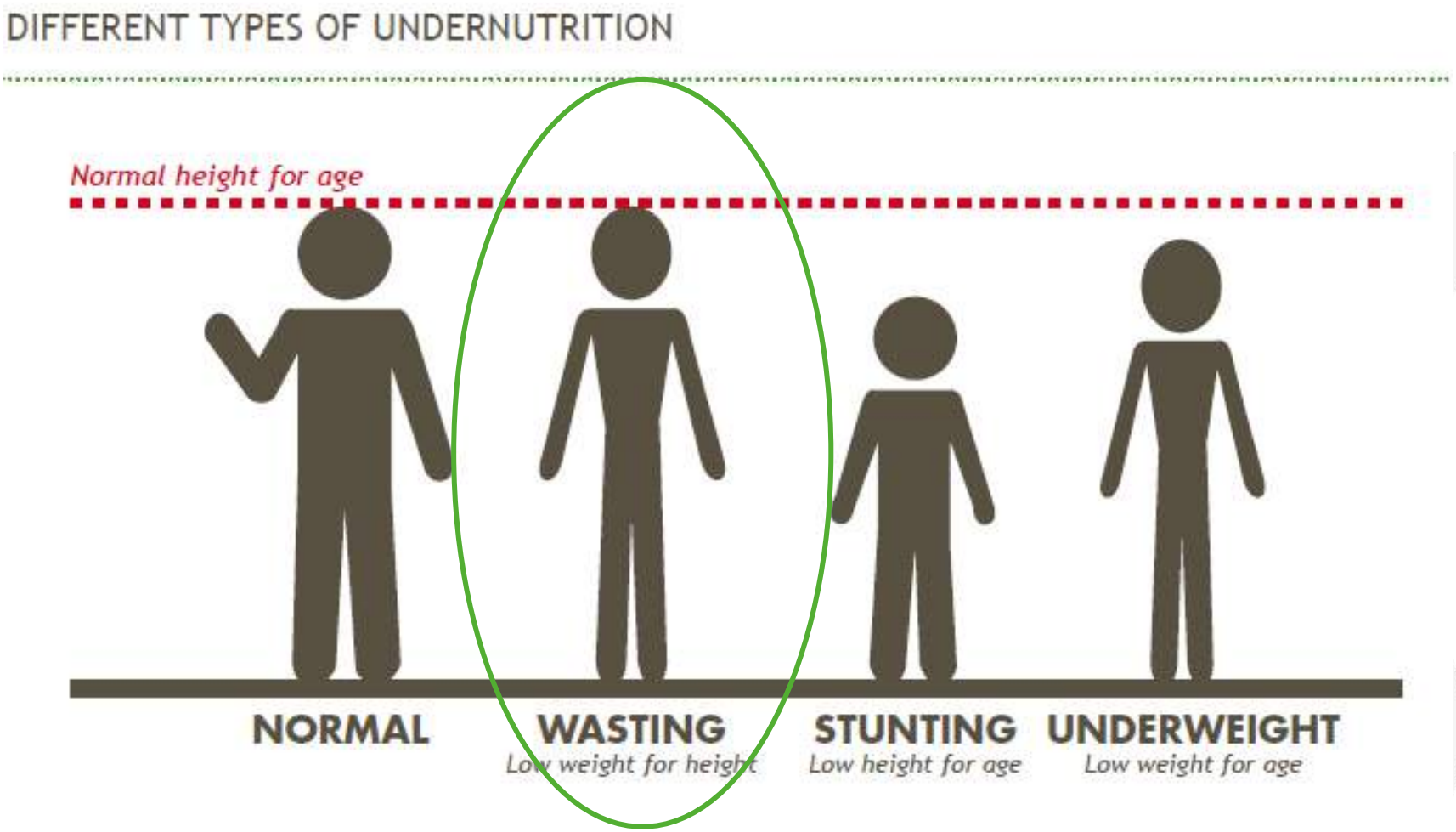
Published in the American Journal of Tropical Medicine and Hygiene, march 2018

Jean Lapegue, ACF, jlapegue@actioncontrelafaim.org

Authors & Partners

- **Action contre la Faim France, Paris, France**: Mathias Altmann, Chiara Altare, Jean-Christophe Barbiche, Jovana Dodos and Myriam Ait Aissa
- **Institute of Tropical Medicine Antwerp, Antwerpen, Belgium**: Nanette van der Spek
- **Alliance Sahélienne de Recherches Appliquées pour le Développement Durable, N'Djamena Tchad, Chad**: Mahamat Bechir
- **Gent University, Gent, Belgium** : Patrick Kolsteren
- **Donors:** DFID, ACF

Preamble



Source: World Vision (2015), "Definitions of hunger"

Research hypothesis

Nutrition rehabilitation of SAM could benefit from a complementary WASH intervention at the household level:

a) Improving water quality and hygiene-related care practices at household level would decrease the incidence of diarrhoea during the Outpatient Therapeutic feeding Program (OTP)

b) It would improve children's treatment:

- recovery rates and time-to-recovery
- daily weight gain

c) This would possibly reduce the risk of relapsing after successful discharge

Research Objectives

Additional benefits of a WASH intervention among 6 to 59 month-old children admitted to an OTP in the Kanem region in Chad:

a) Primary outcome:

relapse rates at 2 and 6 months post-recovery

b) Secondary outcomes:

- recovery rate,
- time-to-recovery,
- weight gain,
- diarrhoea longitudinal prevalence at OTP discharge.

Study location: Mondo and Mao Districts

Kanem region: 333,387 people

Health background Data

Prevalence of acute malnutrition reported beyond emergency thresholds in 2014 (17.3% global acute malnutrition and 3.5% severe acute malnutrition [SAM]) → WHO alert thresholds being 15% (GAM) and 2% (SAM)

In 2013, the ACF Kanem nutrition rehabilitation program admitted around 11,000 children for non-complicated SAM:

- 73% successfully treated
- 10% did not respond to the treatment
- 7% transferred to hospital or died
- 10% abandoned the program

More than 20% admission relapsed from a previous cured SAM episode

Besides acute malnutrition, diarrheal diseases represented the largest notified disease among children (32% of the HC admissions). The prevalence of intestinal parasitic infection is reported to be 60% (95% confidence interval [CI] = 53–66), and worm infestation has been attributed to water quality

Community Management of Acute Malnutrition

CMAM:

Out-patient treatment of Severe Acute Malnutrition (SAM) in children 6-59 months

- Middle-Upper Arm Circumference (MUAC) < 11.5cm
- No medical complications. No kwashiorkor (edema)
- Weekly provision of rations of Ready-to-Use Therapeutic Food (RUTF)

Status:

- Cured if MUAC>12.5cm in max 120 days
- Not recovered when MUAC<12.5cm after 120 days
- Defaulter when absent for 2 consecutive visits
- Transferred to in-patient care if complications
- Died

Study Design

- Cluster-randomized controlled trial embedded in a routine nutritional program for outpatient SAM management supported by Action Contre la Faim
- Health centers were the unit of randomization. 20 HC of the 35 existing in the study area were included in the study based on their location (they were not contiguous from each other to avoid contamination among participants)
- All new admissions without complications were eligible to the study
- Children transferred from other HC, where their treatment had already started were excluded
- Routine criteria for OTP admission included children aged between 6 and 59 months with a weight-for-height *Z* (WHZ) score of <3 and/or a mid-upper-arm-circumference (MUAC) of < 115 mm, and/or the presence of mild or moderate bilateral edema
- Children with signs of medical complications requiring inpatient management or severe bilateral edema were not included in the study

Intervention

- Among the 1,603 children, 845 were in the intervention group and 758 in the control group.

- Both groups received OTP services as routinely implemented (as per the national guideline for nutrition rehabilitation) and basic hygiene education and care practice sessions during HC visits.

- Intervention clusters additionally received the household WASH kit at admission and two extra home visits for assessing and reinforcing adherence. Kit composition :
  - a safe drinking water storage container with a lid,
  - water disinfection consumables (180 chlorine tablets),
  - 12 bars of soap for hand washing,
  - a plastic cup with handle (to facilitate child safe drinking water practice),
  - A laminated leaflet with picturing the main hygiene messages.

Data collection and analysis (1)

- The study recruitment phase lasted from April to December 2015 and the follow-up phase finished by May 2016
- 10 field monitors were recruited locally and received a technical training
- The HC staff members as part of their routine procedures collected weekly data on sociodemographic characteristics, nutritional status, morbidity, and treatment
- All analyses were conducted in STATA 13 (Stata Corp, College Station, TX) on an intention-to-treat basis by using the full dataset
- Statistical significance was set at < 5% with a two-sided test
- WHO standards with recommended flag limits were used (5 standard deviations [SD] for low weight for height [WHZ])
- Kaplan–Meier multilevel survival analysis was used to display the length of stay, with time-to-recovery and a maximum stay of 12 weeks

Data collection and analysis (2)

- Multilevel mixed-effects linear regression models at individual level were used for all outcomes, with a random effect for clusters to account for the clustered design
- All models were adjusted for the number of missed visits (no treatment because of RUTF shortage), WHZ score at admission, gender, and age of the child
- Outcomes were presented as means with their standard errors for continuous outcomes and as rates for binary outcomes estimated from the models
- Intervention effects were presented as absolute differences with their 95% CI
- Longitudinal prevalence for morbidity outcomes was only measured during the time that the child was in OTP and defined as proportion of time under observation with the disease
- Total morbidity was calculated by summing up all symptom days

Ethics

- The trial was registered at clinicaltrials.gov under the identifier: NCT02486523 and approved by the General Secretary of the Ministry of Public Health in Chad and the institutional ethical review board of the Institute of Tropical Medicine in Antwerp
- The CONSORT guidelines were followed for this report
- An oral informed consent was obtained from all caretakers whose child was eligible for the study.

Adherence to WASH kit

1 month 6 months

Adherence to the WASH kit in the intervention group

Indicator	First visit		Second visit	
	n/N	%	*n/N*	%
Correct procedure to transport the water	340/710	47.9	448/686	65.3
Use of Aquatab: water always chlorinated	351/710	49.4	420/686	61.2
Correct chlorination procedure	480/710	67.6	574/686	83.7
Correct turbidity analysis (0–20 NTU)	620/712	87.1	604/690	87.6
Correct residual chlorine present in the water (> 0.5 mg/L)	283/696	60.7	343/677	50.7
Acceptance of chlorinated water	461/710	64.9	540/686	78.8
Correct use of storage container	203/710	28.6	342/686	49.9
Correct procedure for handwashing	307/709	43.3	446/686	65.0
Laminated leaflet present in household and used	673/707	95.2	658/686	95.9

WASH = water, sanitation and hygiene.

Although we notice a progress in basic hygiene practices over 6 months, there is an issue of adherence to the protocol questioning programmatic intensity, effectiveness and sustainability of the WASH intervention

Results (1)

Intervention effectiveness on primary, secondary, and tertiary outcomes

Outcomes	Intervention		Control		Intervention effect		
					Absolute difference	95% CI	*P* value
Primary outcome measure							
Relapse rate at 2 months, *n*/*N*, %	105/623	17.6	91/484	18.0	−0.4	[−7.2; 6.4]	0.911
Relapse rate at 6 months, *n*/*N*, %	10/377	2.6	10/293	3.6	−1.0	[−4.0; 2.0]	0.532
Secondary outcome measures							
Recovery rate (program), *N*, %	783/845	92.4	618/758	81.9	10.5	[6.7; 19.8]	0.034
Recovery rate (sensitivity analysis), *N*, %	675/845	79.4	521/758	69.8	9.6	[6.7; 19.8]	0.043
Time-to-recovery in days (program), *N*, mean ± SE	783	51.7 ± 1.5	618	56.1 ± 1.5	−4.4	[−8.6; −0.2]	0.038
Time-to-recovery in days (sensitivity analysis), *N*, mean ± SE	675	52.9 ± 1.5	521	56.6 ± 1.5	−3.7	[−7.8; 0.4]	0.075
Weight gain velocity (g/kg/d), *N*, mean ± SE	783	4.2 ± 0.2	618	3.8 ± 0.2	0.4	[−0.05; 0.8]	0.086
Absolute weight gain (g/d), *N*, mean ± SE	783	27.5 ± 0.8	618	24.5 ± 0.9	3.0	[0.6; 5.4]	0.014
Diarrhea, *N*, LP ± SE	844	1.5 ± 1.0	749	3.2 ± 1.0	−1.7	[−4.5; 1.0]	0.223

Results (2)

Tertiary outcome measures							
Defaulter rate, *n*/*N*, %	35/845	4.5	36/758	4.8	−0.3	[−3.9; 3.3]	0.880
Internal transfer rate, *n*/*N*, %	8/845	0.9	7/758	0.9	0.0	[−0.1; 0.1]	0.969
Death rate, *n*/*N*, %	2/845	0.2	4/758	0.5	−0.3	[−0.9; 0.3]	0.361
Nonresponder rate, *n*/*N*, %	17/845	2.0	93/758	11.7	−9.7	[−16.9; −2.4]	0.009
Vomiting, *N*, LP ± SE	844	0.1 ± 0.1	749	0.6 ± 0.1	−0.5	[−0.9; −0.06]	0.023
Cough, *N*, LP ± SE	844	0.5 ± 0.3	749	0.9 ± 0.3	−0.5	[−1.2; 0.3]	0.213
Fever, *N*, LP ± SE	844	0.2 ± 0.3	749	0.8 ± 0.3	−0.6	[−1.5; 0.2]	0.159
Total morbidity, *N*, LP ± SE	844	2.2 ± 1.2	749	5.4 ± 1.3	−3.2	[−6.7; 0.2]	0.066

CI = confidence interval; LP = longitudinal prevalence; SE = standard error; WHZ = weight-for-height *Z*.

* All models were adjusted for age, gender, WHZ score at baseline, and number of missed visits because of RUTF shortage.

Results summary

- The intervention improved the recovery rate (10.5%; *P* = 0.034)
- The intervention decreased the time-to-recovery (4.4 days; *P* = 0.038)
- The intervention increased the absolute weight gain (3.0 g/d; *P* = 0.014)
- The intervention reduced non-responders rate (-9.7; *P* = 0.009)
- The intervention reduced vomiting longitudinal prevalence (-0.5; *P* = 0.023)
- No statistical differences in the relapse rates were noticed at 2 (0.4%; *P* = 0.911) and 6 (1.0%; *P* = 0.532) months
- No statistical differences on the weight gain velocity (0.4 g/kg/d; *P* = 0.086)
- No statistical differences for the diarrhea longitudinal prevalence (1.7%; *P* = 0.223)

On-going ACF researches on the subject

PUR 2: Interventional CRT research, Pakistan, effect of HH water treatment on SAM treatment (John Hopkins, P&G, ACF, editing process). Main results AOR (95% CI) :

- Significant increase of recovery rates in water treatment arms (+17-22 %)
- Longitudinal prevalence of diarrhea was found to increase length of stay by 11.1 days
- Water treatment didn't reduce diarrhea rates

DDMAS: Observational Case control research, Pakistan, on the effect of water treatment at HH level on SAM treatment (Brixton Health, UNICEF, ACF, editing process). Main results AOR (95% CI) :

- SAM significantly associated with diarrhoea
- SAM significantly associated with caretaker's hand washing habits
- SAM significantly associated with absence of toilet

PLOS journal "current outbreaks" (published 2018): Observational research paper (published), Hodeida, Yemen, mentioning the link between cholera prevalence and SAM:

- 8% of <5 children are diagnosed SAM at CTC, x5 the national prevalence (1.65 %)

TISA: Interventional CRT research, Senegal, on the effect of water treatment (Aquafloc) at HH level on SAM CMAM treatment, with cost-effectiveness component and systematic biome analysis (LSHTM, under funding process).

Conclusions on WASH effect on Acute Undernutrition

- Provision of water treatment products significantly increased nutritional recovery of SAM children in out-patient treatment programs (OUADINUT, PUR2)
- All types of chlorine based water treatment were found with significant higher recovery rates (PUR2, Pakistan)
- diarrhea prevalence increased Length of Stay in care and reduced odds of recovery (PUR2)
- **SAM is associated with lack of toilets (DDMAS) and improving toilets access reduces SAM prevalence (Gates Mali)**
- **SAM is strongly associated with Cholera, especially in <1 children (…)**
- **Care takers handwashing habits significantly associated to SAM prevalence (DDMAS)**

- Adherence to water treatment still low (PUR2, Ouadinut).
- WASH didn't reduced the relapse rates (Ouadinut)
- WASH minimum package didn't decrease diarrhea longitudinal figures (PUR2, OUADINUT)

- Bacteriological load and typology in water and feces is not systematically measured
- More research needed to understand mechanisms of improved recovery rates
- Sanitation efficiency and effectiveness is arguable on SAM treatment support
- Adherence to protocol and programmatic intensity is at stake
- Cost effectiveness research to be developed (logistic constraint of mass SAM treatment)

Discussion on WASH effect on Undernutrition

	Acute	Chronic
Interventional Research	Proven effect on SAM treatment (Ouadinut 2017, PUR2 2017, Gates Mali 2015, Concern CRAM Chad 2016)	Not proven effect (Shine, WASH Benefits)*
Observational Research	Proven effect or association on SAM prevalence (DDMAS Chad 2017, PLOS Yemen 2018)	Proven impact (Cochrane 2013, Spears India 2012, etc)

* Proposing an explanation: chronic undernutrition is a multigenerational disease, with no treatment, and most of interventional researches are logically short (5 years) compare to the pathology timeframe.

Uptake on WASH'Nutrition

R4Act meeting:

- Where: Paris
- When: Last quarter 2018
- With whom: ACF & CRF, foreseen support from ACF, CRF, IFRC, donors welcome
- Why:
  - To confirm the effect of WASH on SAM treatment.
  - To provide operational recommandations on maximizing the effect of WASH on SAM treatment.
- What:
  - Review of the state of the art around the subject (external consultant),
  - 1 day exchange with around 10 researchers to provide sound and evidence based operational guidance to WASH and Nutrition practitioners
  - An official report shared widely (practitioners, academics and donors)

E learning modules:

- What: 6 modules (Fr, En) → 4 currently under development
- With whom: ACF, CRF, IFRC, WHH, TDH, other partners and donors welcome

UNHCR's Waste to Value Sanitation Portfolio

Murray Burt
Senior WASH Advisor

Protracted Emergency Situations

Focus on improving long term access to WASH services by adopting more cost efficient technology solutions

Waste-to-value sanitation solutions

can process human waste to yield four major types of byproducts...

Waste processing method	Byproducts that address refugee needs	Current solutions
	**Biogas** *(cooking, lighting)*	All camps and all refugees need cooking fuel... ...Wood, kerosene, ethanol currently used for cooking... ...However, no single source can meet 100% of demand
	**Briquettes** *(cooking)*	
	**Electricity** *(lighting, charging mobile phones, pumps, infastructure)*	Solar panels and lanterns are well-received by refugees... ...And the price of solar will decrease even further
	**Fertilizer** *(slurry, biochar, compost for agriculture)*	Not all populations practice agriculture... ...Even fewer camps have space for farming... ...Plus, fertilizer can't be moved far (too heavy to be efficient)

1. Anaerobic digestion produces both biogas and fertilizer as byproducts, and produces as much fertilizer per kg of waste processed as composting methods.

UNHCR
The UN Refugee Agency

WTV solutions will not cover an entire household energy needs. But it can contribute to renewable supplies

START WITH:

Wet fecal sludge

~1.5 kg/ household/ day

Dry fecal sludge

~0.5 kg/ household/ day

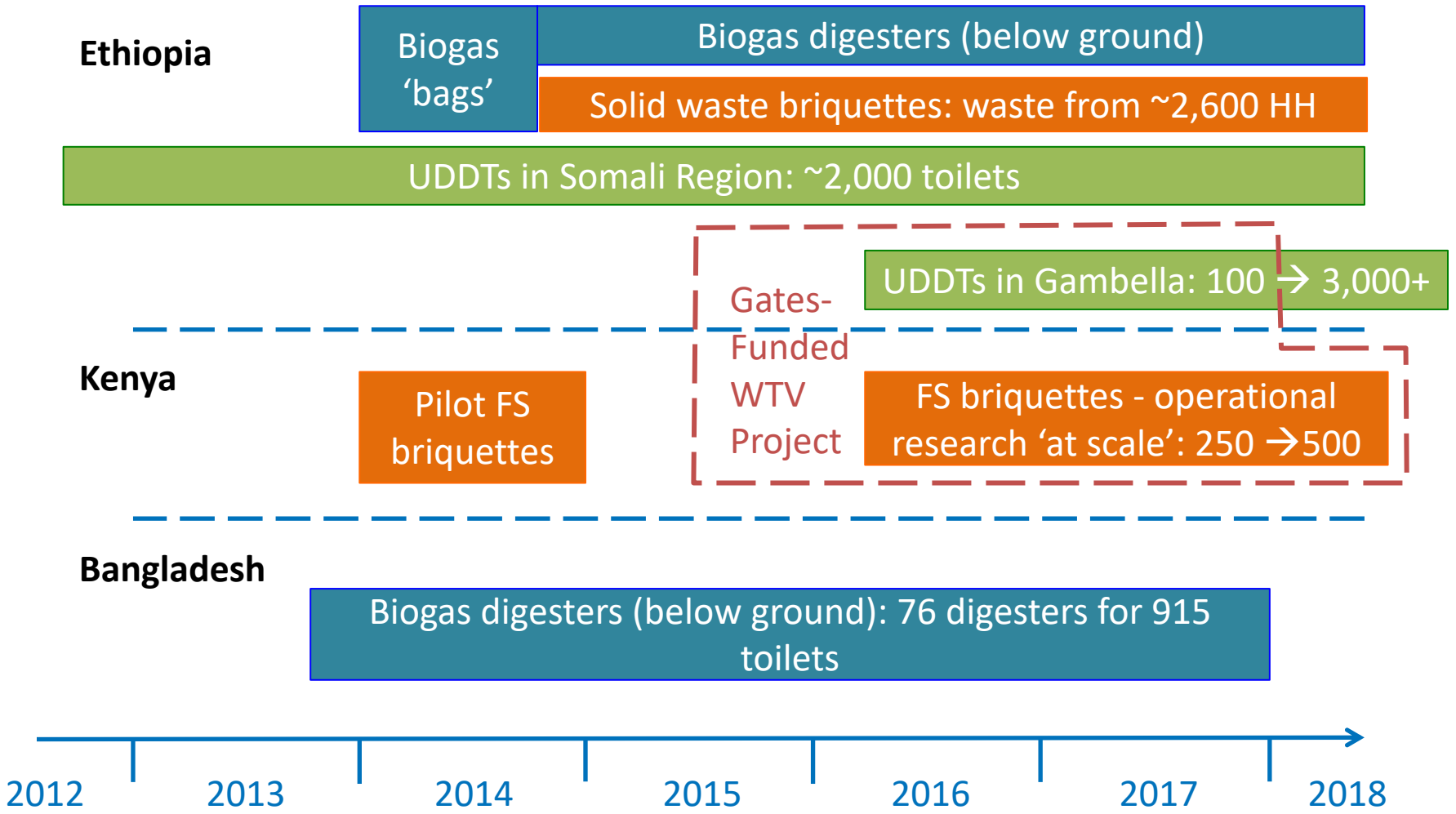
	Maximum extractable value per HH per day	Equivalency
Anaerobic Digestion	0.2 m^2 biogas	~20% of daily household cooking[1]
	Fertilizer w. 11 kg nitrogen per year	100m x 15m plot of farmland per year[2][3]
Carbonization	0.4 kg briquettes	~14% of daily household cooking
Combustion	3.2 MJ *or* 0.9 kWh electricity	72 full Samsung Galaxy phones 60W bulb for 15 hrs
Composting	Fertilizer w. 11 kg nitrogen per year	100 m x 15m plot of farmland per year[2]

1. **100% of cooking needs could be achieved with additional substrate from manure of 1-2 dairy cows, or 1 cow + 1.5kg organic waste/grass.**
2. Assumes 6% Nitrogen content of dried fecal sludge (Resource Recovery through Wetlands, Herbert Aalbers, 1999) and 60-120 kg/Hectare for maize.
3. Anaerobic digestion slurry is better fertilizer than fresh fecal sludge; nitrogen content is the same but is in more usable form (ammonium); P, K, Mg, Ca contents are similar; pH is higher (LTC Bonten, "Bioslurry as a fertilizer"; C.N. Macharia, "Nitrogen Use Efficiency and Maize Yield."

Additional sources include: "Sustainable Recovery of Energy from Fecal Sludge in India," EAI & BMGF, 2011, p. 105; "Fuel potential of faecal sludge: calorific value results from Uganda, Ghana and Senegal" Journal of Water, Sanitation and Hygiene for Development, 2014; interview with Andrew Foote of Sanivation

UNHCR The UN Refugee Agency

Timeline for Solution Development



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Urine Diversion Dry Toilets

Standard Operating Procedures for Refugee Camps

Angus McBride and Caroline Muturi, 2017

http://wash.unhcr.org/download/unhcr-uddt-sops/

Double Vault UDDTs

- $ Infrequent emptying reduces costs
- Waste easy to handle
- Good P, K fertiliser & source of organics
- Safety for use on crops not guaranteed (CDC)
- High in organics: decomposition may cause nitrogen leaching
- Long wait for first batch of reuse product
- Long wait to assess impact of fertiliser

Credits: Angus McBride

User Perceptions

- Very positive
- No smell
- No flies

http://wash.unhcr.org/download/unhcr-uddt-sops/

UDDT Waste as Organic Fertiliser

Solutions to safety & efficacy issues are not great

- **Composting:**
  - technically complex (testing feedstock blends)

Photo credit: Oxfam

- **Multiple barrier approach:**
  - acceptance issues
  - tight supervision needed
- **Use on non-food crops:**
  - lack of experience (UNHCR)
  - respond poorly to fertiliser (esp. trees)
  - land tenure issues

http://wash.unhcr.org/download/unhcr-uddt-sops/

Sanivation Briquette Process

Solid Fuel Briquettes from Container-Based Toilet waste

Sanivation Ltd.

Full sanitation chain as a service

- 2014 pilot (30 toilets)
- 2016-17 Op. Res. (250 toilets)
- 2018-19 Financial model (500 toilets)
- UNHCR processes challenging

Sanivation

UNHCR
The UN Refugee Agency


250 HH


Fuel for 500HH
~24 T/month
@ $ 0.2/kg
= $ 4,000


7.5 T/month wet FS
Sanivation


Mixing & pressing
1.5 T dry FS solids
+ 22.5 T charcoal dust
/ month
Photos: Sanivation Ltd

Solid Waste To Briquettes in Ethiopia

2,572 HH → Collection → 900kg Solid Waste /month → Carbonisation, Pressing, Drying → 180kg briquettes /month → 3 HH monthly needs (60kg /HH/month)

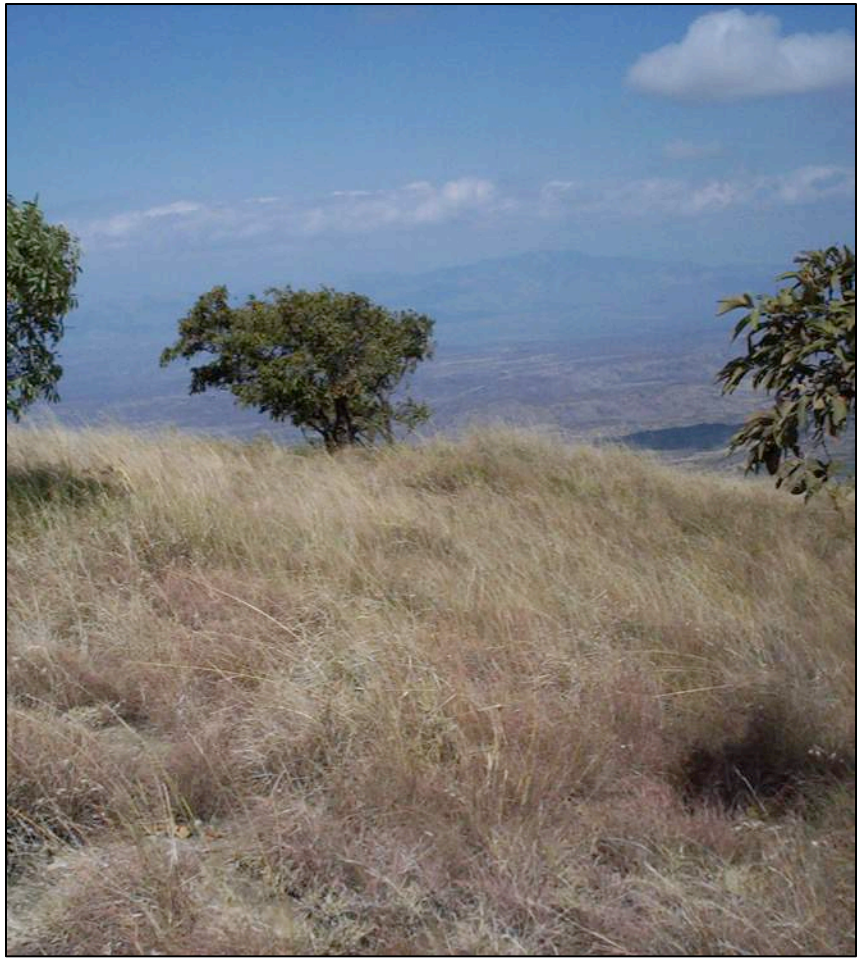
UNHCR
The UN Refugee Agency

Producing briquettes for 50% (30,000) of camp residents – will require alternative feedstocks

Alternative feedstocks include:

- rufa grass
- maize cobs
- bamboo
- mira waste

Detailed financial, economic and environmental analysis required



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Biogas Digesters: Bangladesh

53 fixed dome digesters
915 toilets: 19,760 users
10 – 18 toilets per digester
60% of FSM

53 communal kitchens
~10% cooking needs covered
450 families served
44 litres/person/day biogas

Photo credit: UNHCR Bangladesh

UNHCR
The UN Refugee Agency

Biogas Digesters: Lessons

Photo credit: UNHCR Ethiopia

- Below ground-domed digesters best
  - Relatively simple to operate
  - above ground biogas bag digesters in Ethiopia (see left)
- Communal kitchens shared by small group workable but gas metering advisable
- Digestate a good potential fertiliser but requires some ‘maturation’ and appropriate application

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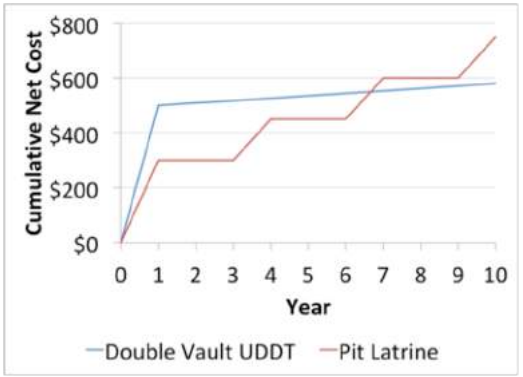
Provisional Financial Analysis

UDDT

Gambella
Ethiopia



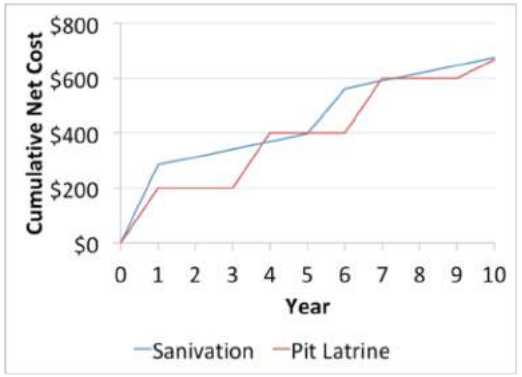
Payback: 5-6 years

(vs.: pit latrine)

Net ~$60/HH/year

Sanivation

Kakuma
Kenya



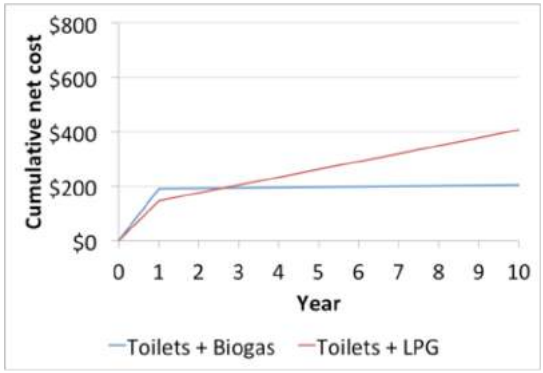
Payback: 10 years

(vs.: pit latrine)

Net ~$60-70/HH/year

Biogas

Cox's Bazaar
Bangladesh



Payback: 2.5-3 years

(vs.: pit emptying, LPG)

Net ~$21/HH/yr

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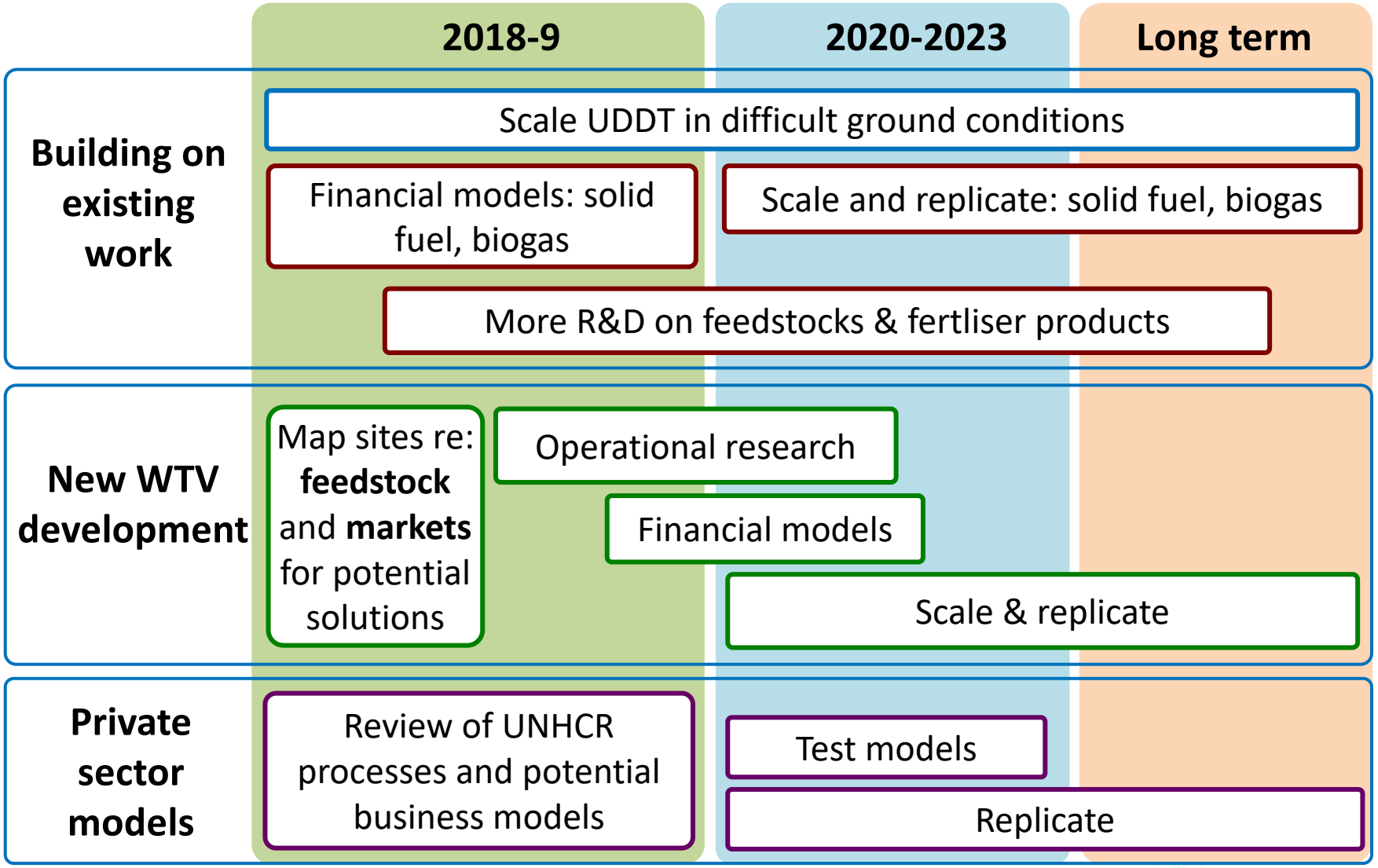
Future WTV Development



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wash.unhcr.org

User-Centred Sanitation Design through Rapid Community Engagement

Consortium Partners:

Save the Children UK

Qatar Red Crescent

Welt Hunger Hilfe

Oxfam GB

OXFAM

Session Overview

- Background to the Challenge
- Landscape Review – Key Findings
- Monitoring and Evaluation
- Evaluating Participation
- Save the Children; Bangladesh and Iraq Trials

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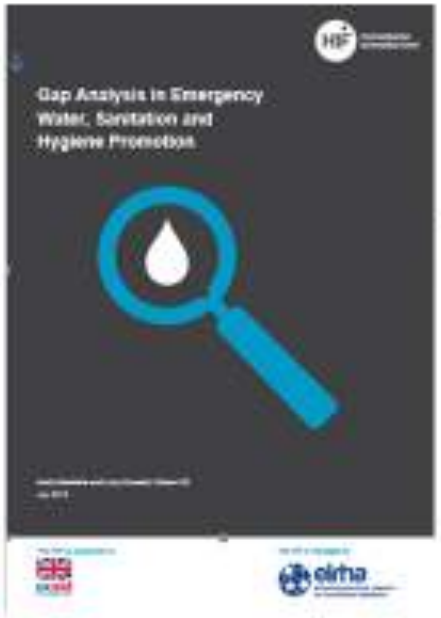
Background to the challenge

Gap Analysis in Emergency WASH
2013 HIF



User-Centred Sanitation
through Rapid Community Engagement
2017 HIF

welt hunger hilfe

الهلال الأحمر القطري
Qatar Red Crescent

Save the Children

OXFAM

Hypothesis :*greater community engagement (including empowerment, trust and mutual respect) leads to improved latrine construction that is timely, appropriate, consistently used and community-owned.*

OXFAM

Landscape Review – Key Findings

What has been tried?



Timing and Phasing



Challenges

Context

Environment

Aid Workers Capacity

Communities

OXFAM

Monitoring and Evaluation

OXFAM

Evaluating Participation

Oxfam 2018: Community Participation

Participation: Communities shape the sanitation programme through a flexible, collaborative process which brings together local and implementing partner perspectives, knowledge, experiences, resources, and capacities

OXFAM

Save the Children

eclipse

Child Participation in Sanitation Design in Emergencies

Save the Children eclipse

Rapid Engagement METHODOLOGY

DIGITAL 1

CO-CREATION

CONSTRUCTION

DIGITAL 2

3 months

Save the Children

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Bangladesh Trial

LOCATION: Nayapara refugee camp – Rohingya crisis

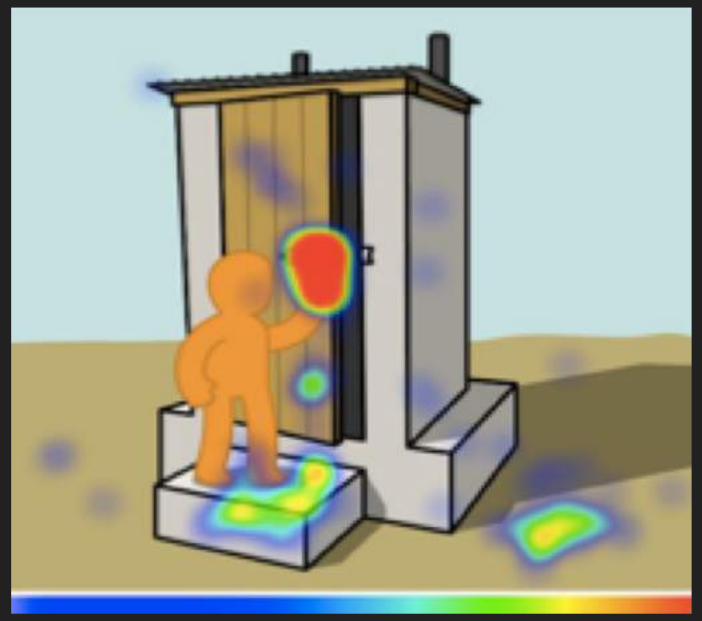
Participants = 200 Children and 143 Carers

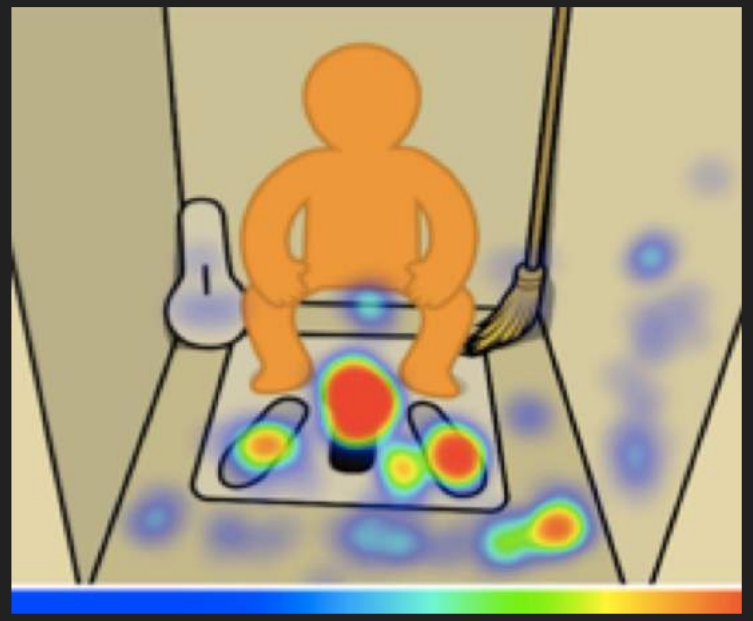
- Current sanitation practice by children (reported by caregivers)
  - **Latrine = 45.5%**
  - **Open defecation = 53.2%**

- **Children were much less satisfied with camp latrines than adults:** only **15.5%** of children were satisfied, compared to **46.2%** of adults.

‘’’ IMPORTANT TO GIVE CHILDREN A VOICE ‘’’

Digital 1 – interactive heat map (Bangladesh)





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Co-creation session (Bangladesh)

Commonly identified pain points	Agreed action
The **location** and area surrounding latrines: found to be dirty, far away from home, not easy to walk to and with long queues	*Consider adequate proximity of the latrines to the household*
Locks: too high, difficult for children to open and/or broken	*Improve design of the lock – lower, easier to open and close*
The size of the **hole and foot rests**: too big for children	*Smaller spaced footrest latrine slab*
The **cleanliness** of the inside of latrines: too dirty, smelly and too many flies	*Ensure management of latrines by allocated HH, provision of cleaning product and tools*
Lack of water to wash hands	*HH handwashing devices already a part of the ongoing programme*

Save the Children

eclipse

Iraq Trial

LOCATION: Sharia IDP camp, Dohuk, Iraq (protracted crisis)

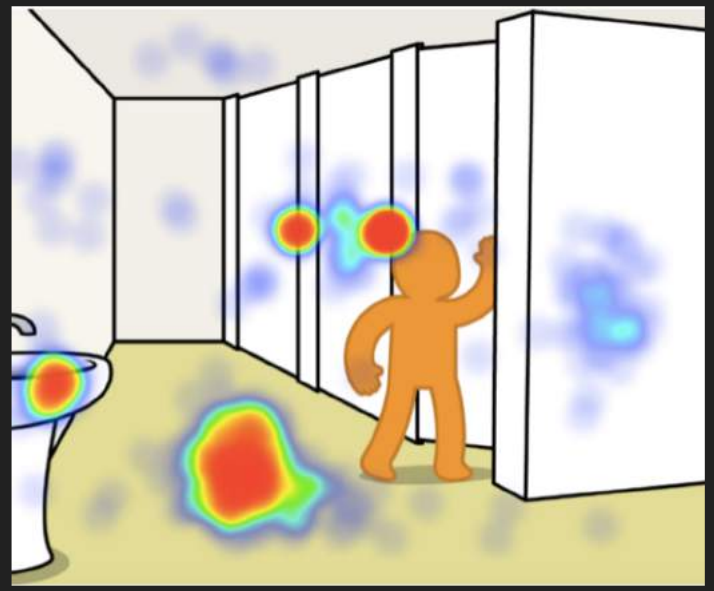
Participants = 407 Children and 167 Carers

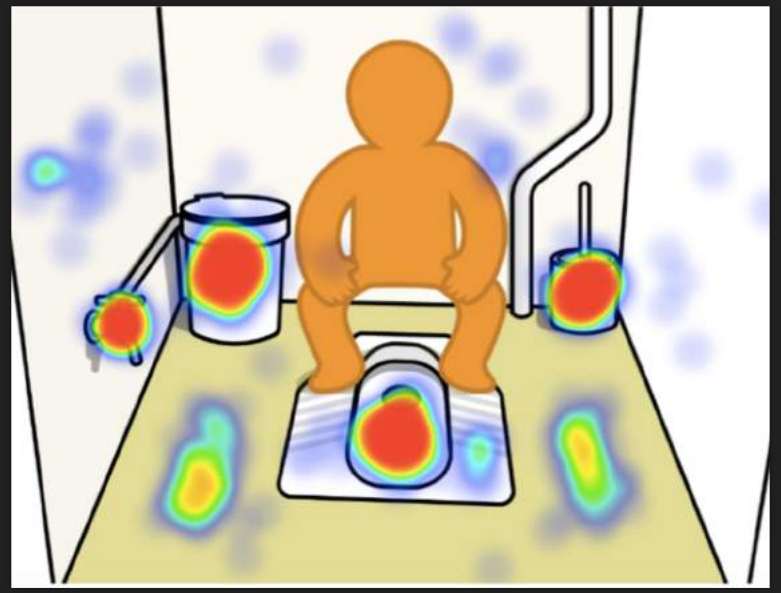
- Current defecation methods by children:
  - Latrine = 99.4%
  - Open defecation = 0.4%

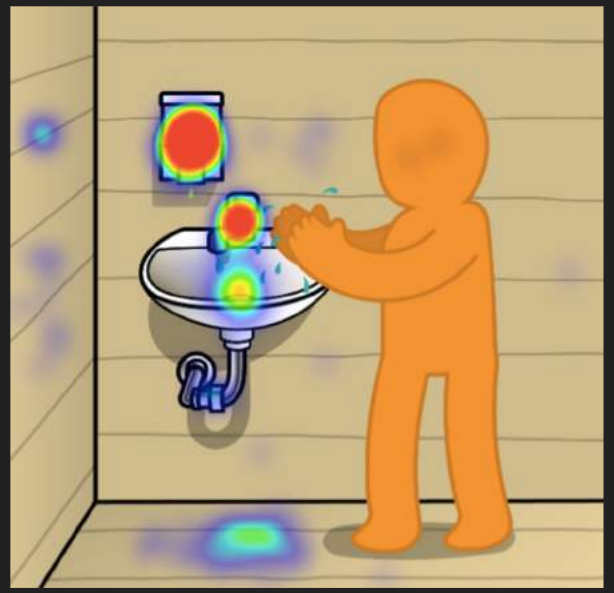
- **Children were much less satisfied with camp latrines than adults:** only **10.8%** of children were satisfied, compared to **19.2%** of adults.

Save the Children eclipse

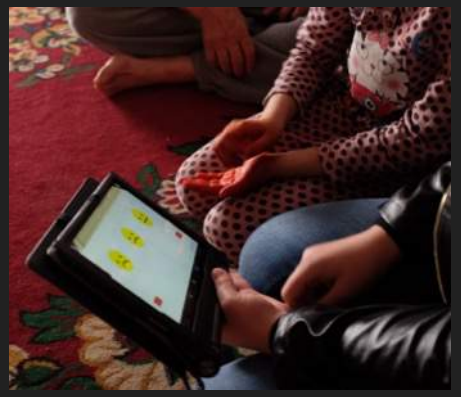
Digital 1 – interactive heat map (Iraq)







Co-creation session (Iraq)



Commonly identified pain points	Agreed action
There is no **soap** available at Handwashing facilities	*Repair of all handwashing stations and inclusion of a built in soap dish.*
Corridor area is **dirty**, **wet and dark** – no electricity, children scared of animals	*Cleaners to be re-trained. Hygiene promotion to increase focus on effective latrine use using both adult and child HP activities. Lighting to be considered in future budgets*
Lack of **waste bins**, bins full	*No budget to install for this project – will look to budget for future installation. Ensure cleaners are monitored for improved performance*
Inside of latrines are **dirty**	*Increase HP focus on effective latrine use. Ensure regular cleaning undertaken*

Feedback from Staff on Methodology

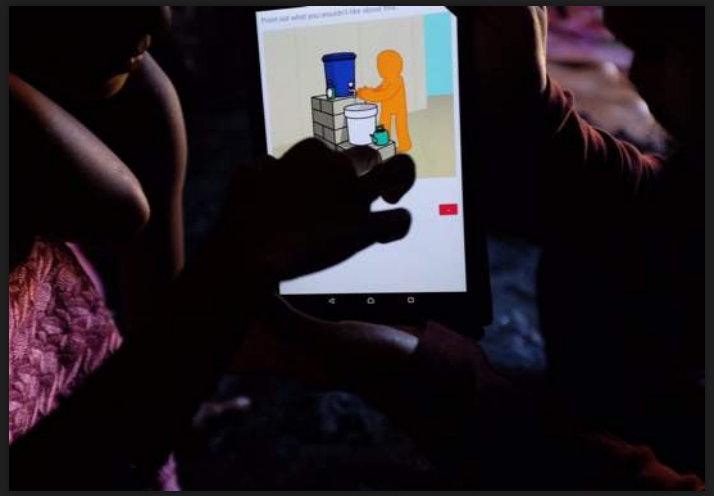
- ✓ Found the activities **easy to undertake** – particularly the digital tool
- ✓ Use of **pictures helped with difficult language** exchange
- ❖ Felt it was **difficult to fit in with the ongoing response** work – saw it as a separate project, not a tool to improve service delivery
- ❖ Engineers if not on board – **influenced the output** to what they believe is needed.
- ✓ Engineers on board- believed it helped increase **good relationship with the community**, orientate children and carers on the **importance of using latrines**, it gained a **result quickly**.

Achievements to date

- Total participation = **607 children and 310 carers**
- **44 child friendly latrines** have been constructed
- **822 latrines being rehabilitated** to make more child-friendly

- Digital 2 to be carried out – **feedback and iteration**

- **Evaluation** to be carried out by SCUK and Oxfam May-June
  - Did it increase use of latrines by children?
  - Was the methodology appropriate for use within emergencies?
  - Did affected children and carers feel the engagement enabled them to effectively participate? and did the facilities provided reflect their inputs?



Save the Children eclipse

CONTACT

Dr Katrice King – Save the Children

k.king@savethechildren.org.uk

Elli Panagopoulos – Eclipse Experience

elli@eclipse-experience.com